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THE ZOOLOGIST:

A MONTHLY JOURNAL

OF

NATURAL HISTORY.

FOURTH SERIES.—VOL. XX.

EDITED BY

FRANK FINN, B.A., F.Z.S.

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PREFACE.

It is with very great regret that we have to announce the cessation of this journal as a separate publication.

Although the flow of literary contributions has been fully maintained. and we have had regretfully to return several interesting communications which would have served for a New Year's number, the increased support from Subscribers which, as we said at the beginning of the year, was necessary, has not been forthcoming.

This being so, and the main interest of the 'Zoologist' having for many years centred chiefly in the British avifauna, we look with considerable satisfaction on the fact that Messrs. Witherby & Co. have taken it over for amalgamation with their publication 'British Birds,' which is, we understand, to widen its scope so as to include the birds of the Western Palæarctic Region generally.

It is of course understood that only ornithological matter will be required by the conjoint publication, and of this only such as will deal with the birds of the area above-mentioned, and we hope that the same loyal support will be accorded by our observers to 'British Birds' as has been the pride of this old-established magazine.

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JANUARY 15TH, 1916.

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FRANK FINN, B.A., F.Z.S.

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THE ZOOLOGIST

No. 895.—January 15th, 1916.

SOME FISH-NOTES FROM GREAT YARMOUTH AND NEIGHBOURHOOD FOR 1915.

By Arthur H. Patterson
(Associate of the Marine Biological Association of Great Britain).

The Great War has been by no means conducive to an accumulation of my East Coast Fish Notes; on the other hand, it has been most disastrous in its effects upon the fishing industries connected with this and adjacent ports. The Herring fishery had been, up till the commencement of October, practically at a standstill, whilst considerable numbers of fishermen and others connected with this great industry had gone either into the Navy or kindred branches that appertain to it, or had departed into other spheres of labour, not a few going into the Army. A few of my notes will have a somewhat warlike flavour.

During the first week in October some score Scotch boats had arrived to fish from this port, and a few fisher-girls had come south to engage in gutting and pickling operations. Abnormal prices marked the progress of the fishing, varying in degree according to the numbers and qualities landed. Record figures were obtained, which will be mentioned later on. Our shrimping fleet had been much reduced in number of boats, partly owing to the depleted ranks of the men; and those who also remained to dredge for Shrimps, and put in their small trawls for mixed catches, did so under certain restrictions which much hampered them.

It is just possible that, thanks to a greatly reduced pursuit of them, some species, marketable and otherwise, have numerically benefited by this abnormal close season—certainly two or three species, which will be mentioned later on, visited us more numerously, or at periods when not expected—and it has been remarked that the fewer boats engaged in the Herring fishery have made proportionately greater catches. The quality of the Herrings, to my mind, has been superior; I have never enjoyed such fat and palatable Herrings as have blessed my table during this fateful "voyage."

The shrimpers found themselves restricted in their fishing areas; but catches of "Brown" (Sand) Shrimps were fairly well up to the average. Some grounds annually worked with success were forbidden, others were fished only at intervals, owing to the diverging times of the tides, night-fishing being prohibited. At the well-known "ross" ground (a *Sabella*-covered area) between Gorleston and Lowestoft, where "Pinks" (*Pandalus montagui*) are most abundantly met with, numbers of the Common Prawn (*Palæmon serratus*), of a goodly size, although not so large as taken in the Channel, were somewhat numerously captured—probably the lessened disturbance favoured their visits. Sometimes two or three pints of them were netted by one shrimper on a tide, whereas in past years odd ones only had been caught, and were exhibited in the shrimpers' windows as objects of curiosity.

Having regard to Mr. H. N. Milligan's remarks on his captive crustaceans,* the following facts may be of some interest: "Pink Shrimps" (Æsop Prawn) are hereabouts caught in 7 to 10 fathoms, on rough ground ("ross"). "Browns" (*Crangon vulgaris*), with a small sprinkling of *C. trispinosus*, etc., are sought closer inshore, in 2 to 3 fathoms, the sunnier the weather the better. On an easterly wind, with the water "sheer" (clear transparent green) hauls are poor. A north-westerly wind thickens the water, and if followed by a westerly or south-westerly breeze, catches are greatly increased. Too much nor'-westerly wind sends round "muck" (broken red sea-weeds), making hand-sorting slow and laborious. For "Pinks"

* *Vide* "Hardiness in the Common Prawn, Æsop Prawn, and Shrimp" ('Zoologist,' September, 1915, p. 359).

the dredges are down an hour, "if they go clear," *i. e.*, do not foul wreckage, or enclose some unwelcome boulder; these crustaceans mostly die in the nets, none surviving many minutes even if drawn out of the water alive. "Browns" will live all night in a cool place—*e. g.*, in baskets on a cellar floor—and go kicking into the copper next morning. Common Prawns will live for several hours; I examined some late in September that kicked vigorously when handled three hours after coming out of the water, even after they had been buried among the common catch, with layers of the deceased Æsops above them. It is a matter, no doubt, of capacity for living by preference in the more shallow aërated water. Than the "Pink Shrimp," fresh and warm from a Yarmouth copper, no crustacean can be sweeter to the palate, the Harwich and Lowestoft methods of salting and boiling producing an infinitely less tasty dainty.

"Bob" Colly, one of the most entertaining of my shrimper friends, who corroborates the above remarks, tells me that the League Hole, inside the Holm Sands at Corton, near Lowestoft, is the favourite "Pink" ground of the local shrimpers; and that the largest "Browns" are met with off Bacton and Hasbro'. Here also, the nets used being trawls, some good catches of Soles are often made in July.

Towards the end of 1914 young finger-length Grey Mullet were abundant in local waters, the Breydon smelters netting many.

Sea-fish at that time being so scarce, nothing that was edible was rejected; and ridiculously small Skate were brought to market that would at any other time have been esteemed too insignificant for sale. It was fortunate that at the year end and early in January some numbers of small Cod were captured by long-lining, and these for some time were the primest of the fish on sale. On January 1st a well-known Breydoner, "Blue" Calver, who for most months in the year lays pots for Eels, baiting them with Shrimps and Viviparous Blennies that he captures in a small trawl-net, put his trawl-gear into Breydon, and secured on two or three occasions numbers of Flounders, a species in no great local repute. The first lot realised thirty shillings, an hitherto unheard-of figure; and the second, twenty shillings. I recognised the fish, on sight, on a fishmonger's slab,

as Breydoners, so many being yellow, brown, and blotched on the under side, a feature due to the irritation of the colour-pigment cells by water and environment not quite so pure as the open sea. They were not plump fish, like the "grass-fed" Flounders taken in August, when feeding on the crustaceans and mollusca haunting the *Ulva* and *Zostera*.

Sprats were still being caught off the Suffolk coast up to January 7th.

January 8th.—A very fine Tadpole-Fish or Lesser Fork-beard (*Raniceps trifurcus*) was captured on a long line, with Cods, off Yarmouth. The ugly head was as large as a hen's egg.

Two fresh and beautiful eggs of the Lesser Spotted Dogfish were brought to me on January 21st, that had been recently swallowed by a John Dory; the tendrils were quite perfect.

"Spraggs" (immature Cod running to 7 lb.) were still fairly common in the fish-shops up to January 27th. Large Herrings from Norway had been lately coming to the fish wharf; and on the same date as above "set" Sprats, lustreless and insipid of taste, were being hawked about the town.

January 29th.—One of the large bombs dropped by a Zeppelin in the town (which I had myself seen in a stable lying in the straw not six feet from a pony!) was taken to sea and exploded by a time-fuse in 12 fathoms of water. It caused a considerable disturbance in the sea, and a 20-lb. Cod, victim to the explosion, floated to the surface—an example of "frightfulness" much appreciated by the boatmen who landed it. On the same date I examined a 2-lb. Plaice, which was somewhat singularly formed; the body was unusually rounded in shape, and the tail, instead of going out straight, turned off at a tangent to one side.

Red Mullet.—In company with some small Dories on a fish-slab I observed to-day (February 2nd) a couple of Mullet, each 5⅜ in. long, which answered to the coloured drawing in Couch's 'British Fishes.' They were whole-coloured—a blood-pinky hue—without any suggestion of the yellow streaks seen in the Surmullet. The heads were not so obtuse as one might have expected. I have never yet seen what I am really satisfied answers to the *Mullus barbatus* of Linnæus, unless these speci-

mens were identical with it. Couch, in saying, "It may happen, perhaps, that the mere circumstance of colour will not prove sufficient to distinguish them," would seem to have had his doubts also.

Half a bushel of Flounders were lying on a fishmonger's slab to-day (February 23rd); the largest of them would easily have been covered by a longitudinal slice of lemon. I was assured that they were on sale for the cats, but the locality was against this suggestion.

March 4th.—I weighed an East Coast Herring at 12 oz., a rather large one, although many of the Norwegian "grandfathers" of the shoals exceed that weight.

March 8th.—Saw a Smeared Dab (*Pleuronectes microcephalus*), about 1½ lb. in weight, with the whole underside, save the head, of the same colour as the upper surface. Colour-variation is by no means common in this species.

Large Herrings.—I examined a number of Norway Herrings in a little fish-shop to-day (March 21st), which ran fairly large. Several were 13 in. in length, and 7 in. round them at the deepest part. An example in another shop, said to have come from Scotland, weighed ¾ lb.

The late Mr. de Caux, in his book on 'The Herring,' refers to his largest example as 15½ in. A Yarmouth "'Longshore" (a term expressive of its local nearness of capture) runs to 10 and 11 in., with a weight of from 4 oz. to 6 oz. I have weighed a 14-in. Herring at 14 oz.; and Mr. R. Beazor assures me he had a 16-in. fish, turning the scale at 16 oz. I weighed one on December 5th, 1900, that for a length of 15½ in., with a girth of 7½ in., scaled 14½ oz.; and yet another on December 17th, 1895, at 14½ oz., that was ½ in. less round and the same in length, a slightly heavier roe undoubtedly making the difference.

It seems to me rather curious that a milt (male) Herring takes the salt less intensely than a roe. The majority of local persons buying a red (smoked) Herring ask for a "hard roe"; I myself much prefer a "soft-roed 'un" (*i. e.*, a male fish), as being of a milder and much superior flavour.

Comber Wrass (*Labrus comber*, Ray.).—Two examples of a Wrass, corresponding intimately with the coloured figure given by Couch ('British Fishes,' vol. iii, Plate CXXVI), were captured

in a shrimp-net on March 31st off the town. One measured 2½ in. in length—a bright, well-marked fish, with a series of silvery-white dashes and dots running from gill-covers to tail, on either side, on a basal colouring of rich mahogany red. Belly paler, inclining to yellow. The back was dotted with brown at the base of the fin-rays. Fins much the same hue as the body, and the iris was crimson. The colours faded rapidly. The description as given to Couch, from the west of Cornwall, by fishermen of Mount's Bay, was to the effect that it was "the most slender and graceful of the Wrasses—the head smaller, lips thinner, jaws more lengthened and pointed." But he admitted that he had not yet examined a specimen.* Pennant mentions an example received from Cornwall, and describes it much in the same terms, giving a very respectable engraving of it, from which, I should imagine, Yarrell ('British Fishes,' vol. i, p. 489) had his woodcut copied, although reversed.

Mr. R. Q. Couch, writing to the 'Zoologist,' states he had seen but one specimen, but that Cornish fishermen mentioned that "several are caught every summer."

My second example was 2¾ in. long, but of a much darker hue.

Day ('British Fishes,' vol. i, p. 253) vaguely deals with the Comber, and classes it with the *varieties* of *Labrus maculatus*. Probably he had not seen it.

If *Labrus comber* be a true species, it is an interesting addition to my list of East Coast fishes.

On April 10th the 'Angler's News' provided its readers with a list of "specimen fish" taken in British fresh waters in 1914. Among them the following local captures are worthy of note:

Pike	January	Weight 24 lb.	Oulton Broad.
Pike	February	Weight 23 lb., length 40½ in.	Barton Broad.
Pike	March	Weight 20 lb. 8 oz.	Barton Broad.
Perch	August	Weight 2 lb. 12 oz.	Hickling Broad.
Chub	July	Weight 6 lb.	Little Ouse, Brandon.
Bream	August	Weight 6 lb. 4 oz.	Waveney, Somerleyton.
Bream	October	Weight 5 lb. 13 oz. (Worm-legering.)	Bare (Norfolk).
Roach	October	Weight 1 lb. 15¼ oz.	Waveney, Beccles.

* Yarrell, however, remarks that Couch "has also met with this fish."

The summer Mackerel-fishing was a poor one. Mackerel were scarce and dear. A 'longshore boat in May made one catch, numbering 2500 fish, that realised £26. The spring Herring fishing was not of much account, no drifters going to sea; only a few 'longshore boats ventured out and made small catches. The Herrings, small and tasty, sold as bloaters as high as threepence *each*, a hitherto unheard-of price.

On *June* 28*th* I received a note from Mr. R. Beazor, saying: "I have got a fine albino Brill and a hybrid Brill and Butt [Turbot] (one of two that I had) if you would like to see them. 'German caught.'—Yours, etc., ——."

It would appear that a British submarine had captured a German smack "somewhere in the North Sea," and our tars, for some reason which I am not quite sure of, made the vessel tow our own undersea craft into port (!). The catch of fish, which included some fine Turbots and a number of particularly good-conditioned Haddocks (probably taken well to the eastward) realised £100 on the fish wharf. I saw among the catch two hybrid Turbot-Brill, weighing, perhaps, 3½ to 4 lb. each. One fish was Turbot-shaped, with the almost normal upper Turbot colouring; a few splashy white spots, and an immense number of small, blunt, ill-defined knobs (answering somewhat to the spiny excrescences on the skin of a normal Turbot) were sprinkled over the upper surface. These numbered, in fact, six times the usual quantity found on the true Turbot. The under surface was white, but curiously freckled with lozenge-shaped "impressions."

The other fish was practically an albino. Almost the entire upper surface was white, smooth, and glassy to the touch. A few tiny dots of brown, and one blotch the size of a half-crown, only broke the uniform whiteness, and a small figure-8-shaped patch of grey formed a curious setting for the eyes. The dorsal fin started abruptly some inches behind the head; but on the head itself, just behind the eyes, a tuft of fin-rays, like a rough small paint-brush, made a grotesque suggestion of eyebrows (!).

July 14*th*.—Note: "Some of the shrimpers are getting nice lots of Soles. At Sheringham the fishermen are catching quantities, using lugworm as bait."

I had sent me on June 25th a small fish from Wendling, near

East Dereham, for identification. A letter accompanying it stated that, in a pond in which only Tench were known to exist, most unexpectedly scores of small fishes on a warm, sunny day came to the surface, some as large as a Herring among them. They would not take a bait, but one was captured in a bow-net and forwarded to me. The fish was a Prussian Carp (*Carassius gibelio*) 5 in. long. It was identical with those found for many years past in a roadside pond at Lound, a half-dozen miles from Yarmouth, but not of quite so golden a hue. Dr. Day, with his usual eagerness for discarding species, describes this fish as a *variety* of the Crucian Carp. As I had suspected, my friend informed me that the Wendling pond was "very thick" and weeded at times, and used by horses and cattle. Knowing the conditions at Lound, my friend's remark that "these Germans take a lot of killing" was very much to the point."

Pilot Fish.—A very fine 11½-in. example of the Pilot Fish (*Naucrates ductor*) sent me on July 17th from Milford Haven for identification. It had been captured forty miles west of St. Anne's Head, Pembrokeshire, and had aroused much curosity among the fishing population. The fish was very Mackerel-like in shape: the ground-colour was a greenish-blue, with fine bluish-black bands, each ½ in. wide, encircling the body, which gave it, at a first glance, a curious appearance of having been regularly tied with black tape. The fish had been taken amongst a school of Scads. I sent it to Mr. Roberts, of Norwich, for preservation for our local Tolhouse Museum.

Perch (*Perca fluviatilis*).—A number of fishing-boats (steam-drifters) were sent up the rivers after the 1914 fishing to be out of the way of the harbour traffic. Some went up the Yare from Yarmouth, and a number of Lowestoft boats went through into Oulton Broad; a few were moored at St. Olaves, opposite the cutting wherein lay my summer house-boat. The bottoms became weeded, attracting numbers of Shrimps and young fishes—Roach, Smelts, etc.—which no doubt found small crustaceans there among. To these also came numbers of Perch. At Oulton an angler, drawing to the side of an Oulton vessel, threw in his line while holding his umbrella, and to his surprise the float disappeared the moment it reached the weeds. He repeated the throw, and in the end had made a respectable

bag. Others followed suit. At St. Olaves a young Territorial, fishing with a stick and short line, by way of experiment dropped his bait—a boiled Shrimp—near the bow of a fishing-boat, and immediately hooked a Perch, successive captures running larger until he secured a pound-weight fish. On August 2nd I found they eagerly seized Shrimps; placing my bait a foot below the float, I allowed the tide to take it along, and at the end of each swim brought a Perch to book. I noticed these fish most eagerly pursuing young 1½-in. Smelts and Roach of a similar length.

I observed that the Perch were very faintly barred on their sides, and, when dry, these bars had entirely vanished. Their contact with the salt tides seemed to give them a very palatable flavour, and none were wasted. Opened along the back, like a kipper, rubbed with salt, and hung up to dry for an hour, they came, still in their jackets, from the fry-pan as deliciously flavoured as a Trout. Lubbock ('Fauna of Norfolk') refers to the Waveney Perch as delighting to come up as far as the "salts" to prey on Shrimps.

August 9th.—To-night the water pouring up river to Breydon was unusually bright with phosphorescence. Every tiny wind-puff edged the wavelets with silvery gleaming; my punt's prow cut a widening angle of fire as it divided the stream, and even my mooring ropes clove the surface into wavy lines of brightness. I thrust my eel-rod into the depths, which glowed luminously a fathom below the surface. It was an ideal time for the Smelts, which jumped out of the stream, making big splashy circles of brilliancy as they captured, or missed, some playful little "Whitebait," that was itself out for prey still smaller.

During August I had a fairly good spell of eel-catching; on Breydon by eel-spear and "bab," and on the Waveney by the latter only. The eel-spear is gone much out of use since Breydon has so deteriorated. In the sixties quite a score Breydoners looked upon Eels as their principal catch—by spearing in deep waters in winter, and by babbing on the flood-tide in the finer months, using the spear when working the flooded flats; on a four- to six-foot staff when the tide was up. On one occasion a "bed" of Eels was discovered in the "Fleet," when quite a rush was made, some men, while it lasted, earning as much as ten shillings in a day. Only a few amateurs now go up for a "mess" of Eels,

working hard to get it* ; whilst only two or three semi-amateurs more seriously "bab" for sale. As I have elsewhere stated, the old Breydoners of my younger days are dead. "Short'un" Page, "the last of the Mohicans," at the moment of writing aged and decrepit, is spending the late winter of his days in the infirmary.

A few observations on Eels made during my summer holidays may be briefly summarised: When feeding, Eels refuse but little that comes in their way. One vomited in my eel-trunk a piece of raw beef; another, measuring 15 in. and showing a distended abdomen, on opening it it was found to contain a 4-in. length of bacon-rind, making the stomach in shape like a tennis-racket. An aged Breydoner told me that when babbing near the Haven bridge he broke his pipe and threw in the pieces. He noticed soon after one Eel with a lumpy appearance, and curiosity tempted him to skin it. From the stomach he took out a part of the pipe-shank. To skin an Eel with least trouble the tail must be struck against a hard substance. No matter how lively an Eel may be, the moment the vertebræ near the head are severed it hangs limp as a dead worm. Eels die quickly in crowded eel-boxes, undoubtedly of asphyxiation, and eel-catchers are always eager to send off their fish as soon as possible after capture; yet they will take little harm from sewage water, although the slightest admixture of tar, petrol, or pungent oils sends them away in a great hurry. I was catching Eels on one occasion when a piece of greasy cotton-waste touched the "bab"; not another bite did I get. Stale worms, unless they are very hungry, will not tempt them, so that fresh worms are necessary nightly. A "bab" is a 2- or 3-yd. chain of threaded worms, wound in coils around the hand, then tied and weighted with a conical-shaped leaden sinker. Eels are fickle: one evening they will bite freely on one side of the river, on the next they are found on the opposite only. It is a good plan to try several places until they are found. On the river they bite better on the early flood than at any other time of it. Eels will "mud" in the marsh ditches

* Eel-picking is now confined to the Main Channel, which is over 20 ft. deep, or in summer, with the babbing, chiefly confined to the shallower "drains" or creeks that drain the ebbing waters from the now much-raised and hardened acres of mud-flats.

when drought stagnates, and the water is low; a "let in" of fresh water from the river through the sluices enlivens them at once, as those who use the "lamb-net" are well aware.

Scad.—During the latter part of August quite an unexpected invasion of "Horse-mackerel" (Scads, *Trachurus trachurus*) came to the shallow waters. I saw a 50-lb. catch, taken by a lad before breakfast on the morning of the 20th; some of them scaled 1¾ lb. For a few days excellent sport was enjoyed by those who cast angle from Britannia Pier; the fish bit fast and furiously, not rejecting a bright, naked hook. On one occasion a soldier, home for a rest from the Front, secured no less than 140 fish.

It is rather curious that small shoals of only very juvenile Bass should occasionally visit this neighbourhood; these are seldom more than a span long each, whilst a few miles down the Suffolk coast, more particularly at Aldeburgh, they are habitually larger and abundant. The 'Angler's News' of September 25th records: "Large hauls of Bass at the harbour-mouth (Aldeburgh) by means of draw-nets. One was hooked from the south beach weighing 12 lb. 2 oz. It took a small Whiting, and gave the angler a 200 yards' run!"

Two fine, full, 'longshore Herrings were taken in a smelt-net on Breydon during the first week in October; their advent here is a very rare occurrence.

October 18th.—I had noticed Dog-fish (Tope and Piked Dog) lying in a heap on board the fishing-boats, and find that a ready sale exists for them nowadays, their skinned carcases being sold as "Flake." On several occasions I have wandered by the tide-mark and among the byeways in the neighbourhood of the fish wharf, finding it a rare thing now to see a Dog-fish thrown away. On this date I called in at the back premises of a leading fishmonger, and found three hands busily at work skinning a trunk of Dog-fishes. Some had been netted in an oily area, and their skins were black with the sticky liquid; this, however, mattered little, for with a few dexterous movements their jackets were drawn off, and a headless and now tempting-looking carcase was ready for a purchaser's attentions.

Flounders.—On November 6th I went up Breydon on the low ebb-tide, taking my eel-spear and butt-dart, the latter very

much like a rake with six barbed spikes running vertically with the 10-ft. shaft. As the tide falls the Flounders, which may have been scudding around and among the *Zostera*, scutter down into the runs, and as these run dry those which do not "ground" get into the larger drains that do not altogether empty of water. The Flounders search for Shrimps, Gobies, and other small prey among the weeds that collect in eddies, or on the rougher shelly grounds that scrunch audibly under the stabbing dart, as the tines pierce the layer of empty clam-shells. The fish, as the tide returns, gather in the vicinity of the mouths of the runs, waiting for greater depths in which they may roam and feed when the flood-tide makes.

I secured 70 Flounders, some up to 10 in. in length, thick and well-fleshed, not a few from 8 in. upwards being big in roe. Fifty-four were right-handed fish, and 16 were left-handed, or reversed. The difference is quickly apparent when one is beheading the fish, as a left-handed example makes a different handling of it necessary. Most were very dark brown on the upper side, and several blotched and coloured on the under surface. Two only, fresh from the sea, had not yet darkened the yellowish-brown hue habitual when living in a sandy habitat. One only was afflicted with parasitic growth, and this was confined to the pectoral and anal fins. It corresponded with what Dr. Lowe described in his Norfolk Fish List (Victorian History) as a "skin disease resembling epithelioma—large fungous growths cropping out all over the body. The granulations large and roe-like—under the microscope, consisting of large nucleated cells."

Inspector Donnison's half-yearly Reports on the Eastern Sea Fisheries are as usual interesting, although not so bright as on the early days before the war. The Norfolk Mussel industry, as usual, looms up largely in its details. When some 3000 cwt. are sent away in a couple of months (December, 1914, to January, 1915) from the north-western corner of the county, one may imagine that the industry is not a small one. The Inspector mentions that "a large quantity went by railway and steamer to the wholesale merchants at Hull, taking the place of the Dutch Mussels usually imported there." In the half-year Report, ending September 30th, he states that "the quantity of Mussels taken from the beds and layings in the Boston (Lincs.)

and Lynn Fisheries during the previous season was 87,500 cwt.—verily a little harvest of the sea!

Mr. Donnison's opinion that, owing to the great restrictions placed on the steam-trawlers, who on ordinary occasions follow the spawning fishes "until the territorial limit is reached," there should be more fish migrating thither, accords with my own. He refers to a "Cod different to the Cod generally caught," coming to the East Coast at the end of 1914, which "had dark skins and small heads, were very plump, and went up to 29 lb. in weight." A crew of long-liners received over £60 for catches obtained in five days' fishing. By January 23rd the fish had all disappeared.

Young Codlings were brought in pretty freely on the Norfolk coast in November; on the 12th they were numerous in local fish-shops. I have kept an eye upon them with a view to verifying Mr. Donnison's note on the smaller-headed fish, but so far have not satisfactorily done so. Codlings ran larger at November end, a few up to 11 lb. (the largest) were hooked off the Jetty. A sea-angler, fishing from the Britannia Pier, hooked a large Cod, which broke away, taking trace and lead with it. Thus encumbered, the unhappy fish soon became wearied out and "blown," and the lead detached, a roughish sea tumbling it ashore, when the hook, still fixed in its jaw, was identified as the lost one. Fish weighed 22 lb.

The Whitings were few, and no remarkable catches were recorded; probably the prevalence of so much easterly wind may account for their scarcity.

In the September Report mention is made of Dog-fish becoming a well-established marketable food. Hitherto those taken have been used for bait. Trawling for "Pink Shrimps" (Æsop Prawn) had been very remunerative, one crew's earnings averaging £7 a week. "Occasionally 70 pecks were obtained by a vessel in a day." It is interesting to note that horses are employed around the Wash to drag nets. Crabs landed up to September 30th approximately numbered 940,000, and Lobsters 29,050. "These totals were below those of the six seasons (1909–14), the highest in Crabs being 1,250,000, and in Lobsters 48,100."

Starfish (*Uraster rubens*) of large size "raided" the Lynn

waters; and "small Starfish . . . did much mischief to the brood Mussels"; many of these "in extreme diameter were between the size of a threepenny and a sixpenny piece," and by the Inspector's measurements and calculations would require considerably over 4,000,000 to weigh a ton. "Small as the Starfish are, up to two and two and a half tons have been taken in a day. Starfish are fond of Cockles. I have observed a large one devouring a Cockle and holding over a score others on the suckers of its five arms or feet."

I cannot dismiss these entertaining Reports without referring to the notes on the Lugworm. Since sea-angling has become so popular, huge quantities are obtained for the tackle-shopkeepers, who retail them at about tenpence a hundred, keeping them in drawers, something like fruit-trays, in a rack, the worms being spread on sacking wetted with salt water. They die rather quickly, so that, owing to the vagaries of the weather, the business is a somewhat precarious one. Some forty men in the neighbourhood of Wells alone are engaged wholly or partly in digging for them. Many of the worms are used for long lining in the immediate neighbourhood. The men, roughly speaking, average 1200 worms apiece; "one," says the inspector, "had obtained 2000 worms in a tide"—*i. e.*, on the ebb, which uncovers the low-lying sands for a remarkable distance. "Worming" and "cockling" are pursuits at variance, and, it is evident, to the detriment of the last-named industry.

With regard to the Sprat-fishing at Southwold, Mr. Ernest E. Cooper wrote me on December 4th: "I regret to say that up to date our Sprat-fishing has been a failure. None were caught in October; a few were caught during the first ten days in November, but the weather was stormy, and on the 9th one of our men and his son lost their lives through their boat being swamped. Then the wind set in from the east and north—gales, frost, and snow—and the Sprats disappeared. This week the wind came southerly again, and when the sea moderated the boats got a few Sprats; yesterday about 150 bushels were landed at the Harbour, and if the weather keeps fine and open the men may still make a short fishing. In addition to the weather they are hampered by the military restrictions, only being allowed to be off during daylight. [Night is best for Sprat-fishing.] The

majority of our fishermen are on war service in some form or other, and practically all the young men have gone."

Mr. Cooper mentions the capture of four five-bearded Rockling (*Motella mustela*) by rod; this species has been somewhat frequently hooked of late. "A female Gemmeous Dragonet or Skulpin (*Callionymus lyra*) and several Unctuous Suckers (*Liparis vulgaris*) in the fish-trawls." Sand Dabs (*Pleuronectes limanda*) were numerous in the Bay during the summer months. He describes the early winter sea-angling for Whitings and Codlings as "very poor, and no big fish."

Large Bream.—A large Bream (*Abramis brama*) was caught in the Wensum, four miles from Norwich, on December 5th, and was exhibited in Mr. R. Marsham's tackle-shop window, in the city, by whom it was afterwards sent to the Fish Department of the British (Natural History) Museum. Mr. C. Tate Regan, on an examination of the scales, suggested its age at about fifteen years. A well-known angling expert describes the fish as "a perfect dream." The fish, which had succumbed to the wiles of a paste bait, weighed 7 lb. 14½ oz. Lubbock ('Fauna of Norfolk') described a Bream of 5 lb. as "a very large one." An example was recorded by the late Mr. J. H. Gurney, senr., taken at Cossey, near Norwich, many years ago, as weighing 7 lb. 1 oz., with a length of 25½ in.; depth, 8½ in. The late Dr. Norman, in the seventies, caught one weighing 8 lb. 12 oz.; and the late Dr. John Lowe (Norfolk Nats'. 'Trans.,' 1884) records a Bream of 11½ lb. taken at Beeston Regis on June 17th, 1879, and another at Thorpe, near Norwich, on the 23rd, weighing 8¾ lb. It is probable this last is identical with that taken by Dr. Norman, but I have not been able to verify this opinion, although Dr. Day ('British Fishes') suggests it. The 11½ pounder was estimated by Day to be twenty-six years old, but Seeley ('British Fresh Water Fishes') places it at fifty years.

Writing to me on February 7th Dr. Laver, of Colchester, thus refers to Sprats used as manure: "Sprats always interest me, even when sold for manure. . . . It was the custom for our [Essex] stow-boat men to go out and stay until they got a large number, the small quantity not paying at the low price they fetched. Of course, the first caught became bad, and were fit for nothing but manure. After prices went up it paid to come

in with the few, with the result they go to market or to the picklers, who send them to Norway, etc." In a subsequent letter Dr. Laver, speaking of the catching of Eels, as pursued in his vicinity, wrote: "With reference to Eels, did you ever notice how much nicer they are when caught in the sea than those caught in fresh-water ditches?* In this district there are several boats constantly engaged in the trawling on the *Zostera*-covered shores for Eels. I have never seen this sort of trawling employed elsewhere. It pays at times very well, I think, as I have often seen them turn out of the net some thirty or more pounds at a haul. At a good high tide a haul through Breydon would produce a lot." †

Among the few interesting crustaceans I have met with this year I may mention two Edible Crabs (*Cancer pagurus*): one on May 18th, which had an extra point depending at a right angle from the fixed chela, on the right-hand; and another on July 20th, that on the left-hand claw had an extra point on the free chela, the point that met the fixed chela having a bifurcated end.

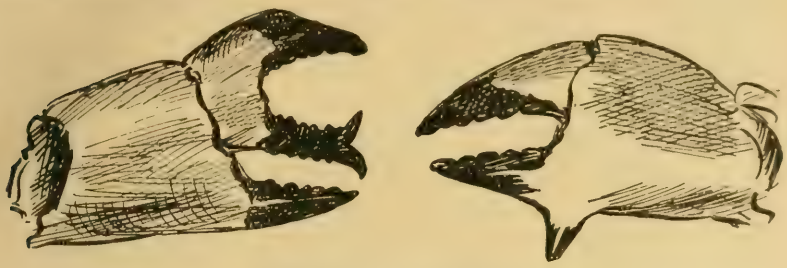
On August 17th Mr. Edward Peake sent me from Trimingham, on the Norfolk coast, a very beautiful specimen of the Velvet Fiddler Crab (*Portunus puber*) that had been taken by a local fisherman, and which I afterwards presented to the Norwich

* It is here a generally accepted fact that "running" Eels, known also as "silver bellies," are of a far less muddy and "fulsome" flavour than those fat, ruddy-bellied fish netted in marsh ditches and stagnant waters.

† I do not think this would be the case, as those two or three who trawl for bait on Breydon catch but very few, and the draw-nets only occasionally bring in two and three fair-sized Eels, among the Smelts, on a single tide. Some years ago, however, a German named Hausemann, a quaint character, endeavoured to introduce one variety of German "kultur" on local waters by eel-trawling, towing his net behind a dilapidated little steam-launch, which cost him £80, and another £20 in tinkering it up. Each haul accounted for a half to three quarters of a stone—a payable quantity on occasion. I have dealt more largely with this character in 'Man and Nature in Tidal Waters,' pp. 208–210. I venture only to add that one night a wooden plug, stuck in a weak spot in the boiler, was shot out when the pressure of steam suddenly went up to 120 lb. (80 lb. being a dangerous figure), scaring the fellow almost out of his wits. This, after he had told his man, "Damme! I can do surely vat I likes mit mine own poat!" He next invented iron eel-pots that had originated in his distorted brain; these, when tried, became buried in the mud, and very soon covered with silt and ooze.

Museum. I first noticed the species for the county in August, 1910, when three were obtained near Yarmouth by a shrimper.

A half-grown male Fiddler Crab was taken with a catch of "Pink Shrimps" on December 4th, and came into my hands. The Æsop Prawns in this catch amounted to two, perhaps three pecks, which seems to suggest this species may be found in some quantities all the year round near the shore.



ABNORMAL CRAB-PINCERS.

The 1915 Herring fishing began in a small way at the beginning of October; fifteen drifters came in with some fish on October 5th, five crans being the top catch, which made 82*s.* per cran. The Herrings were reported as "not large, but of nice quality." On the 9th a steam-drifter put into Lowestoft with two crans of Herrings that made £5 14*s.* per cran, equivalent to £57 per last—a huge price when compared with £2 10*s.* per last (13,200 fish), a price frequently made during a glut. At Lowestoft, on the 18th, the Yarmouth boat 'Try' landed 150 crans, which realised £400. The busiest day of the season was on October 23rd, when over 100 boats came in with catches estimated to be worth £20,000.

The following paragraph, cut from the 'Eastern Daily Press' of November 1st, thus records a remarkable catch, and the largest of the season:

"HAUL OF 280,000 HERRINGS.

"The outstanding feature of the Herring Market on Saturday was the arrival of the Banff boat 'Benison' with a catch to beat all records. The 'Benison' (a most appropriate name) berthed at the new quay in the afternoon and presented a wonderful

spectacle, every space on deck gleaming with silvery Herrings. Her skipper estimated his catch at 280 crans, equal to 280,000 Herrings, and this is the heaviest haul of which we have ever heard. There have been several big shots this season, but the biggest hitherto had been 220 crans. The 'Benison' took her enormous catch from sixty-seven nets and had to let four nets go. This is a remarkable take from such a number of nets, as all fishermen will recognise. The entire catch was sold to one buyer at a price that worked out at nearly £600. The 'Benison' is a sailing-boat, which makes the big haul the more wonderful, but she had been fitted with a paraffin motor."

The last remark, with regard to the additional "motive" power, applies pretty well to all the Scotch sailing-craft fishing from the port. This addition makes them independent of wind and tide, and steam-tugs, adding at a comparatively small outlay to the catching power of the individual vessel, as well as an improved quality to the catches.

Rough weather broke into the fishing at the height of the season, so that the boats were often kept in harbour when they otherwise would have been at work; however, the majority of the catches sold at remarkably high prices, and many boats made a most remarkable voyage. The heavy gale of the 13th, coming suddenly on the fishing-grounds, played havoc with nets, some of the boats losing several. Only three boats brought in fish; one, the Peterhead drifter 'Grateful,' had fifty crans of fish, which sold as high as £6 11*s*. per cran. Ten crans are equal to a "last."

The queerest catch of all was reported to me by a fisherman, "in the know," that "somewhere" in the North Sea, when the nets were hauled by his drifter, up came a German submarine with them covered with "lint" (nets). It is perhaps needless to state, he assured me, that the naval authorities . . . since which that particular cetacean-like intruder has troubled us no more!

The following statistics briefly summarise the fishing for the past three years:

1915.

Boats fishing out of Yarmouth . .	185 drifters.
Number of crans landed . . .	120,122 crans.

1914.

Boats fishing out of Yarmouth . .	370 drifters.
Number of crans landed . . .	177,459 crans.

1913 (Record Year).

Boats fishing out of Yarmouth . .	999 drifters.
Number of crans landed . . .	824,213 crans.

The statistics for Lowestoft may be liberally estimated at nearly two-thirds those of Yarmouth.

A few other items may be worth noting: 1915 saw the smallest fleet fishing out of this port for many years, but the sales of Herrings have made the highest prices ever recorded. The biggest price reached was for a moderate catch, which went at 146*s*. per cran. Last year there were occasions when "over days" went for as low as 10*s*. per cran; none went this year below 40*s*., and this was rare.

The boats plying were of the older type of steam-drifters, the pick of the fleets having been taken by the naval authorities for mine-sweeping, etc. The same remark might almost apply to the fisherfolk! The majority of the catches have been consumed in the Homeland, although the Scotch curers "developed a market in the United States, and local merchants cultivated a trade with France" (from report in 'Eastern Daily Press'). Some of the motor Scotch vessels earned up to £2000 for two months' work, and the larger steamboats made remarkable earnings, in one recorded instance as much as £4300. No boat's fishing proved a failure; the fish were plentiful, and the grounds less crowded with nets. One Scotch boat earned £2400 in eleven days. A boat bought for £650 on purpose for this fishing made £700 in one week.

In ordinary seasons some 200 steamers come hither to load "pickles" for the Continent; this year they were entirely absent, a few small coasting steamers taking what was exported to other ports, for transhipment. The reduced number of Scotch and other buyers, herring-girls, coopers, carters, etc., from North Britain naturally affected the income of the port and town to a very serious extent.

Not the least interesting feature connected with a "fisherman's fishing"—*i. e.*, a remunerative one for the catchers—is its

effect upon the domestic issues, the numbers of those marrying on Christmas morning at the Parish Church, and elsewhere, being much larger than during indifferent seasons. The ancient Yarmouthian axiom that "Of all the fishes in the sea—Herring is king," still holds good in many ways.

December 20th.—A fine roach was caught on the Wensum, near Norwich, on the 19th by Mr. T. Tubby. Weight 2 lb. 7½ oz., length 15 in., girth 12½ in. Our largest Norfolk roach on record is one of 3 lb., with a length of 17 in. and girth of 12½ in. It was caught at Ranworth Broad, on the Bure, on July 31st, 1883.

Mr. Thos. C. Rising, writing to me from Lowestoft on December 22nd, states that "extraordinary shoals of Herring-fry inshored in August, off the town. It was very interesting to watch the small emerald-green Garfish shooting into the midst of a bunch, and seeing the open space they were given instantly; small Eels were also busy in such a feast of plenty. I have also noticed . . . a flock of large Gulls that have been living in some fish-working premises quite in the midst of the town. They stand in a row upon the ridges, and at times fly in circles, and seem to have copied the evolutions of the pigeons. A shortage of fish-offal makes them sharp-set. There are more in the district than ever I saw before." In the neighbourhood of Yarmouth the big Gulls which mustered up so numerously in October had become much scarcer by the end of the fishing. The habit of perching on ridge-tiles, although of long usage in Scotch fishing-centres, is quite a new feature in Yarmouth, having started during the 1914 Herring-scarcity period. The clean-plumaged Black-headed Gull now habitually haunts the filthy outlets of the town sewers.

Mr. Robert Beazor, fish merchant, writes December 24th, complaining that "rare specimens" were notoriously scarce on the fish-wharf during the 1915 fishing, but truly remarks that "this (smaller) fishing and the dreadful war have taught us all a great lesson, for fish which at one time were much despised were now found by all classes of the people, and came to be appreciated by them, as splendid and wholesome food. I must mention two species there were here almost wholly neglected hitherto: First, the widely distributed and abundant 'Dog-

fish' (generic for the family). Until the scarcity of food was felt it was despised, and I have seen tons of them sent to the manure manufacturers. The last year or two fishermen have brought them to the market, where they have been readily disposed of at remunerative prices, and have been bought both by hawker and fishmonger. The antipathy hitherto shown by the public in purchasing this fish led the sellers to call it by a special name—'Flake,' and day after day consumers came [to Mr. Beazor's fish stores] and purchased it. Now I mention Dog-fish, I might say that of the large quantities landed at the fish wharf I only observed two examples of the Spotted Dog.

"Another 'undesirable' turned up in large numbers this year in this locality—the 'Horse-mackerel' or 'Shad' [really, the Scad]. At one time thousands have gone into the wharf-men's refuse-barrow for manure, as no one would purchase them. This last season it was discovered that they were, after all, a most nutritious edible fish.

"I am glad to record a somewhat successful autumn Herring-Fishing. Of course, the numbers of boats employed were small in comparison with other years, the Admiralty making increasing demands for them, so, considering the smaller fleet and the quantities landed, it must be esteemed a successful fishing. From the enormous prices realised, both boat-owners and crews have made a grand 'harvest of the sea.' I had four large Anchovies brought me which were meshed in the herring-nets. The fishermen express astonishment on seeing them."

NOTES ON AN AUGUST NIGHTINGALE.

By O. V. Aplin.

About the middle of August we had a Nightingale for several days in the shrubbery of mixed trees and shrubs I planted a few years ago in front of the house, which is now much haunted by birds. But I never had a Nightingale here before, and its appearance is the more remarkable since this bird is usually rare round here (Bloxham, Oxon.). I had not noticed one in the parish during the spring, although there were two (or three) just on the outskirts—at the Highlands, Tadmarton—on a different sub-soil, or rock rather. Why the Nightingale should be so scarce here, as a rule, it is difficult to say. Possibly the light, red land, overlaying ironstone, does not suit the plants on which some favourite grub of the Nightingale feeds. It was remarked long ago by John Walcott that "it has been observed to be met with only where the *Cowslip* grows kindly" ('Synopsis of British Birds,' vol. ii). And it is a fact that there are very few Cowslips about here. They do not thrive in the red land. Directly you get down Edgehill, on to miserable, poor, stiff, or heavy land, you find Cowslips and Nightingales. The stiff land about Deddington, too, seems to harbour more Nightingales than we have. These remarks about light and stiff lands and Nightingales have, of course, only a purely local bearing.

Our August visitor made its presence known at first by the frog-like, grating cry. It often uttered this, and also occasionally the alarm note, *wit*, in a rather shrill tone. It was very shy, and as the growth is thick I only caught a short sight of the bird very occasionally. But it used to come beyond the new shrubbery into some shrubs only three or four yards from the house; and one morning while we were at breakfast we could hear it croaking close to us, and saw it once. The most interesting point about this visit is that the bird actually sang. This was very noticeable in the forenoon of the 15th, a warm and rather damp morning

with both rain and sun. It did not sing the full spring song, of course. There was no high *pipe* and no *jug*; but merely the irregular notes which are interspersed among those finer ones, and are very largely used by indifferent singers. But though the notes were few, there was no mistaking their richness, power, and volume; no other bird in England has a voice of the same quality. And anyone who knew the Nightingale's song would have recognised the notes at once, and could have identified the bird by them. These little runs of notes were sometimes interrupted by the frog-like croak. The "song" which this individual bird used was somewhat of the same character as that which we sometimes hear from Blackcaps and Garden Warblers late in the summer. These birds do not sing their full song, or, indeed, more than a few notes, at that season. They do not sing the autumn song—here, at all events. But Mr. Tait, writing of the Blackcap in Portugal, where it is resident, says its song may be heard all through the year except in November, December, and January, being more vigorous in spring and fainter in July and August, during which months the bird moults. From this I gather that it sings there the autumn song, in September and October (*vide* 'Ibis,' 1887, p. 91). The Willow-Wren sings fairly well in early autumn (*i. e.*, the bird's autumn), and the Chiffchaff gets his full song in September generally. But I only put these efforts of my Nightingale on a footing with the performances of the Blackcap and Garden Warbler, occasionally heard at the end of summer.

One sees and hears very little of the Nightingale after it has ceased singing; or, at all events, after it has reared its young. I only remember once before seeing a Nightingale in August, and that was on the 12th in 1894, when walking with Mr. Howard Saunders on Foxcomb Hill, near Oxford, but in Berkshire; and I should like to know if anyone, who lives where Nightingales are common, has heard these birds singing even a few notes in the late summer.

The near relationship of the Nightingale to the crepuscular Robin suggests the possibility of the former singing in its winter quarters. But this is unlikely, unless there is some district where the Nightingale *as a species* is found all the year round—though the individuals inhabiting it may not be the same all

through the year. And I do not think such a place exists. Birds do not seem to sing in their winter quarters when those quarters are not regularly inhabited in the breeding season by any individuals of the same species. Robins were not singing in the oases near the Gulf of Gabes in January and February. Nor were Willow-Wrens and Chiffchaffs in Southern Tunis in March (*e. g.*, the 14th). On the other hand, the Black Redstart, another near relation of the Nightingale, sings in autumn and early winter in those countries where it is resident, as a species at all events. I heard a good many singing in October (9th–13th) in the Belgian Ardennes, where it seemed to be going to pass the winter. Mr. Howard Saunders told me he had heard it in Spain in November; and Mr. W. C. Tait writes that in Portugal, where it breeds, it begins to sing from the middle to the end of February, and continues till the end of June. After the autumn moult it recommences its song in September, and goes on till nearly the end of December ('Ibis,' 1887, p. 88). But though the Black Redstart (a non-breeder here) winters in parts of England, it does not seem to sing here. The late Mr. Gatcombe constantly reported seeing it near Plymouth, but I do not remember his ever saying anything about it singing.

Since writing the above notes I have read ('British Birds,' vol. ix, p. 185) an account of a pair of Black Redstarts in Dorsetshire, the male of which uttered a "faint but pleasing warble" on a warm sunny day in the latter part of February. The description, however, does not suggest the full song of this bird. Redwings often sing some sweet twittering notes before they leave us in spring, which are mistaken for the Redwing's full song by those who are not personally acquainted with it. It is to be noted that the Redwing has several times been reported to have nested in this country.

NOTE ON THE OCCURRENCE OF *HETEROTANAIS OERSTEDI* AND OTHER ISOPODS IN CHRISTCHURCH HARBOUR, HANTS.

By J. and W. Omer-Cooper.

In the course of collecting along the shore of Christchurch Harbour, Hants, in May last, large numbers of small Isopods belonging to the aberrant group Chelifera were found among the mud and algæ on the upper surface of submerged stones. Upon microscopical examination these proved to be *Heterotanais Oerstedi* (Kroyer), a species beautifully described and figured by Prof. G. O. Sars in his 'Crustacea of Norway,' vol. ii, p. 14, Pl. VI. The Rev. T. R. R. Stebbing, F.R.S., and Dr. W. T. Calman very kindly confirmed this identification, and stated that they knew of no record of *H. Oerstedi* from the British Isles, the species having been hitherto recorded from the shores of Continental Europe only. This species is of considerable interest on account of the large size and peculiar structure of the chelæ in the male, which are described by Prof. Sars as follows: "Of enormous size, carpus very large and produced in front, outside the hand, to a lamellar lobe, hand imperfectly chelate, the thumb being transformed into a thin, reflexed lappet instricted at the base."

In the same parts of the Harbour in which *Heterotanais* occurs, two other interesting Isopods are to be found in large numbers. The first of these is *Cyathura carinata* (Kroyer)—a species closely related to the well-known *Anthura gracilis* (Mont.), from which it differs in its large size and in several conspicuous anatomical details, chief among which is the absence of the secondary sexual characters seen in the male *Anthura*. This Isopod is to be found in considerable abundance under stones and burrowing in the mud; its movements are slow, and it frequently leaves the abdomen exposed above the surface of the

mud for breathing purposes. It has only been once previously recorded from the British Isles (from East Norfolk, by Mr. R. Gurney in 1907), but the species is well known on account of the work done on its anatomy by various German scientists—notably the account of the statocysts in the tail of this species (under the name of *Anthura gracilis*) by Prof. Thienemann. The structure of the sexual stilet of the second pair of pleopods in the male of *Cyathura* is especially peculiar and interesting, but no description of this appears to have been published.

The third noteworthy species of Isopod occurring in this locality is *Paragnathia Halidaii* (Bate and Westwood), previously recorded by Mr. A. H. Haliday from Strangford Loch in 1847. Since this species was taken at Christchurch it has been found near Plymouth on June 10th and August 18th by Mr. J. H. Keys, F.E.S., while collecting shore insects for the catalogue of the Marine Biological Laboratory, and given for examination to the Rev. Father Morford, who has also examined specimens taken by Mr. Keys some twenty years ago in the same neighbourhood. Dr. W. T. Calman also has a praniza taken at or near St. Andrews in 1898, which would seem to belong to *P. Halidaii*. This species is of the greatest interest on account of its anatomy, which appears to be of sufficient peculiarity to be the grounds for its removal from the genus *Gnathia* and the formation of the new genus *Paragnathia* to receive it. *P. Halidaii* is, in the adult stage, almost terrestrial in habits, and is to be found living in small cavities in the banks ; the males apparently form small holes leading from these, into which they retire in case of danger. The pranizas, like those of other Gnathiidæ, are parasitic on fish.

It is worthy of note that the water in Christchurch Harbour is brackish, and that the species mentioned above are not truly marine, but are found in places where fresh water is mixed with the salt.

SOME BIRD-NOTES FROM SOMERSET COAST.

By Stanley Lewis.

On July 21st I visited Brean Down, that nose-like piece of the Somerset coast which juts out for about two miles into the Bristol Channel at Uphill, two miles south of Weston-super-Mare: the River Axe, after running its course from the caves of Wookey Hole, near Wells, where it first emerges from its subterranean passages of the Mendip Hills, here empties itself into the sea on the northern side of the Down, thus preventing it being reached on foot from Weston, which, however, can be done on coming up the coast-line in the opposite direction from Burnham, but a ferryman is usually at hand, and for threepence rows you the few yards over.

The Royal Society for the Protection of Birds keeps a watcher here, but owing to the war, I think the resident farmer's son, Mr. Edgar Hawkins, keeps a good look-out for anyone taking eggs or killing or taking birds.

Ravens have nested here for many years, and this season four young ones were hatched out, but unfortunately one flew into the tide and was drowned, so that three only got safely off; the Peregrines also hatched off safely with a complement of three: both species nest in a very precipitous part of the cliffs facing the sea near the fort, and although it would seem almost impossible to get to the eyries, this feat before now has been accomplished.

Kestrels had young in the cliffs; their cries could be heard at feeding-times, when the old bird could be seen to rise over the headland and skim back close down on the bracken.

By far the commonest bird on the Down was the Wheatear. This species was everywhere. At one spot where the nettles and ragwort grew together, a pair of birds were very noisy. I soon located four youngsters, hardly able to

fly; these were no doubt a second brood, and the cause of all the bother.

Meadow-Pipits were common, and Linnets were in evidence. Three young Carrion-Crows were hopping after each other as they ascended the southern slope of the Down, and high overhead Swifts circled, their mates no doubt in the fissures enjoying the safety which the cliffs gave them.

Sea holly was growing in places and the prostrate stems of the musky heron's-bill put forth their small flowers amongst the grass.

A Pied Wagtail proved very confiding, and was a welcome visitor as we rested for refreshment in the warm, shingly bay; it stumbled and ran over and between the stones, artfully getting nearer to the crumbs thrown out as an inducement for its company. At first the tempting morsel was snatched and taken off on the wing to be devoured somewhere out of sight, but very soon the bird picked them up from within two yards of my feet, and, running a yard or so more, swallowed them. When enough had been eaten, it thoroughly cleaned itself, wing and tail feathers were carefully preened as it perched upon a stone quite near, and finally it flew away overhead on to the Down.

Two Green Sandpipers were very active, and quickly worked themselves out of sight down the river bank, and Song-Thrushes and Missel-Thrushes were feeding on the flat, intersected land lying between the river and the farmhouse.

The Sheld-Duck is resident and common, nesting principally on the southern side and choosing the shelter of the low bushes and heather, so my informant told me, for nesting purposes, rather than the rabbit-burrows. I think this habit must be partly owing to the protection given them, for, on the sand-dunes not far away, where the birds are numerous and people are more frequent, a nest is seldom found outside a burrow.

In the estuary of the Axe is a tiny rocky prominence known as Black Rock, so called from its sombre hue, and when the tide is in the main portion becomes an island with a rugged growth of grass on the top. On this islet were resting in various attitudes Sheld-Ducks of all growths, from a few days old to half-grown individuals, with old birds here and there. Lower down on the seaweed near the water were forty-seven Oyster-

catchers, some sitting and stretching, others standing sentinel-like, but all with a melancholy aspect, waiting for the ebbing of the tide and the approach of feeding-time.

Nine young Sheld-Ducks left the rock and swam out to seaward; one old bird led the way, and the other, the female apparently, brought up the rear. In the brilliant sunshine they looked lovely; the ducklings resembled little balls of down tossed to and fro on the gentle waves. About twenty more almost half-grown began to swim from the island in charge of two old ducks, and it was surprising how fast these ducklings could swim against the tide.

As the tide went out, several hundreds of Black-headed Gulls, immature and adult, arrived and stood thickly along the shore, moving slowly as the tide ebbed. Feeding with them were a few Herring-Gulls and Kittiwakes, with the Oystercatchers at varying distances from each other as far as the eye could see them.

I distinctly heard the "purre" of the Dunlin, but did not see one. A small party of Ringed Plovers came up the shore, and quickly turning flew outwards to the receding tide. Oystercatchers and Ringed Plovers nest along the shore, and it is quite probable that the Manx Shearwater will some day be included in the breeding birds of Somerset, considering that there are several stations on the west coast from Scilly to the smaller island of St. Tudwals, off Carnarvon.

OBSERVATIONS ON THE BEHAVIOUR OF A NESTLING CUCKOO.

By E. P. Butterfield.

On June 11th last a friend of mine who was on his holidays from Tunstall, Staffs, took me to the nest of a Titlark which contained three eggs and a Cuckoo's egg, which he had found on the afternoon of June 9th on Baildon Moor, an extensive piece of waste ground, which was leased some time ago to the City of Bradford for the use of the public. The day was brilliantly fine when we arrived at the nest, which was about noon, and we found that all the eggs were hatched—three Pipits and one Cuckoo. It is impossible to say how old the nestlings were, but they could not have been two days old, as may be inferred from the above remarks. The Cuckoo seemed to have been hatched a little longer than the Pipits, but still it could not have been much more than twenty-four hours old, as it was quite flesh-coloured, and a young Cuckoo begins to get much darker after this age.

The Cuckoo, even at this age, manifested some restlessness, and wriggled about a little when any of the rightful owners pressed on its back, but still showed no further disposition to eject its fosterer's young. I suggested to my friend a walk round Hope Hill, the highest hill in the neighbourhood, and afterwards a return to the nest. On our return, to our astonishment, we found that one nestling had been thrown out of the nest and was lying on the rim, and we had not long to wait before the Cuckoo threw out the other two Pipits. The method of ejectment was as follows: The young Cuckoo instinctively works its way to the bottom of the nest, where it evinces great restlessness until one of the nestlings rests its head on its back. This induces the Cuckoo to lower its body, and by degrees it is enabled to get the nestling into the hollow of its back; then it commences to walk backwards up the side of the nest, keeping its victim in position by its wings, which it uses with remarkable facility, until it reaches the top of the nest, when, by an extra-

ordinary effort, it throws its victim from its back, after which operation it remains flapping its wings for several seconds, as if to make assurance doubly sure that the process of ejectment has been successful, and then lowers itself and plunges itself into the nest.

In the act of hoisting its victim to the top of the nest the Cuckoo is a most fiendish-looking object; its head, at the end of an extraordinary long neck, is hanging down the side of the nest, of a livid colour, and "didders and dodders" in a most remarkable fashion, and the whole frame seems in a very tense condition. Indeed, after I had witnessed the ejectment of the Pipits, I expressed to my young friend from Tunstall my conviction that the phenomenon was one of the most marvellous sights in Nature. We stayed about the moor during most of the afternoon of June 11th, leaving the nest for an hour or so at a time, and on our return to it we invariably found one or more of the Pipits on the rim. The old bird never showed the slightest disposition to help it's own young back again. Once on my return I flushed the mother—at least, I presumed it to be the mother—when I could not be more than three to six feet from the nest, and by the time I arrived the Cuckoo was just on the point of throwing out one of the Pipits. I could hardly have believed this if I had not had ocular demonstration of the fact. The day was warm and I had a supply of dipterous larvæ, which both the Cuckoo and Pipits ate with avidity, so the young birds did not at all suffer any inconvenience from our repeated visits. There were an abundance of adult Cuckoos in the immediate neighbourhood, but not an individual showed any interest whatever, or came very near the nest in question during the whole of the afternoon.

On June 12th my friend and I visited the nest again, arriving at about 7 a.m., and found all the three Pipits thrown out of the nest, but all were alive. One, however, died shortly after. Mr. Parkin, whom we found at the nest, brought a Pipit's egg from a nest he had found, which he introduced into the nest containing the young Cuckoo, but it was not long before the Cuckoo ejected the strange egg. Then he introduced a young Whinchat from a nest near by, and, perhaps, four days' old; the Cuckoo soon made two attempts to throw it out, but failed both times, as the Whinchat was not properly balanced on its

back. It seemed evident that it was going to be a tough business for the Cuckoo to throw the Whinchat out. We left the nest for some time—perhaps for the better part of an hour—and found, on our return, that the Whinchat had been thrown out. We stayed about the nest for some time before it made another attempt to eject the Whinchat when replaced, and it again failed in its attempt.

June 13*th*.—Again visited the nest on Baildon Moor by way of Stony Ridge, arriving at nest at 12.30 p.m.; met Mr. Parkin on Saltaire Bridge, who told me he had just come from the nest, and witnessed the ejection of the only Pipit left and the operation of the ejection of the Pipit's egg, both of which he had replaced in the nest. On my arrival the young Pipit was lying on the rim of the nest; the egg, however, was still in the nest. I replaced the Pipit in the nest, but the Cuckoo showed no disposition to eject it for some time. Then I put the young Pipit on to the back of the Cuckoo, but it made no attempt to eject it, but jerked it from its back with a certain degree of irritability. This I repeated several times with the same results. When I placed the egg on its back, the Cuckoo showed no disposition to eject it. I may here state that the weather at this time was quite dull and much colder than yesterday; this, I thought, to some extent might account for the Cuckoo's inaction. However, I left the nest, and fetched one of the young Whinchats, and on my return to the nest the day was quite sunny. In the meantime the Pipit had again been thrown out, but the egg was still in the nest. I introduced the young Whinchat, when the Cuckoo at once began to show signs of restlessness, and not many minutes elapsed before it had the Whinchat well balanced on its back, and was climbing up the side of the nest. I surmised that the operation was going to be successful, so I immediately began to flatten out the area round the rim of the nest. This I did in order to ascertain whether I could induce the Cuckoo, after having thrown the Whinchat from its back, to push it still further from the nest than it had hitherto done. The Whinchat, having been heaved to the top of the nest and thrown out, the Cuckoo, as usual, kept flapping its wings. At this stage I placed the Whinchat against the Cuckoo, when, with great vigour, it began to press the Whinchat further away from the rim of the nest.

This I repeated several times, until the Cuckoo had pushed the Whinchat at least three inches from the rim of the nest. I naturally wondered whether the Cuckoo would find its way back into the nest. This it did, by stretching out its neck to its utmost limit, which is saying a deal, towards the nest, accompanied by two or three steps forward, and then fell rather clumsily into the nest. Mr. Parkin asked me whether I had seen the Cuckoo void any excreta, as information had been given him which seemed to negative this idea. However, to-day I saw the Cuckoo twice within a few hours part with fæces, but not in such large quantities as were voided by the young Whinchat. I left the nest to go to one of my sons, who resides near Keighley. On my way I called to see a friend who lives at Morton, and, being interested in birds, he mentioned a friend who took the photo of the nest of the Ring-Ousel containing a young Cuckoo, reported by me in the 'Zoologist' for 1913, p. 391, after which I told him I had only recently left the nest of a Titlark containing a young Cuckoo. He expressed a strong wish that I would show his friend the nest, since he very badly wanted a photo of a young Cuckoo—a request I could not deny; so, instead of seeing my son, I was soon on my way back to Baildon Moor. On our way my friend showed me the nest of a Missel-Thrush, built in a very unusual situation—nearly on the top of an exposed wall, near the caretaker's house, at a reservoir.

On June 14th I went with one of my sons to the nest of the Titlark, and we found both the Pipit and egg outside the nest. On putting the young Whinchat into the nest once more, the Cuckoo did not manifest such a keen desire to hoist it from the nest, but on pressing the Whinchat against the Cuckoo, the latter heaved the Whinchat to the top of the nest, and, by repeating the finesse adopted the previous day, I induced the Cuckoo to push back the Whinchat three or four inches from the rim of the nest. On visiting the nest again some time later the Cuckoo could not be induced to throw out the Whinchat. The desire for exclusive possession of the nest was becoming gradually weaker. The last of the three Pipits I found quite dead to-day, it having lived about four days. It could not, however, have lived this length of time except by artificial means; it must have been

replaced in the nest at least twenty times, and then the weather was bright and warm at the time; and there is every reason to believe that the parents used to feed the young even when it was thrown out.

June 16*th.*—Took my wife and a daughter to see the young Cuckoo. The hollow in its back is rapidly disappearing, and when I introduced the Whinchat into the nest I could not coax the Cuckoo to throw it out. Cuckoos to-day are falling off in their song.

June 18*th.*—Visited the nest with Mr. Priestley, of Bradford, who wanted a photo of the Cuckoo. This is getting now quite a fine fellow; his tail and bastard-wing are feathering very nicely, but the back is yet almost as destitute of feathers as when newly hatched.

My friend had great difficulty in securing a photo on account of the Cuckoo keeping its mouth open, partially opening and closing its lower mandible at the same time. When I touched its body it showed great irritability, and displayed great pugnacity when my hand was placed near the nest; it puffed out its neck-feathers, erected feathers on its head, hissed almost like a serpent, raised itself up, and stepped back in the nest—this latter movement in order to increase its momentum in its attack. Any object placed on its back it tried to throw off with violence, and once I heard for the first time its call-note.

June 19*th.*—Again visited the nest in the morning and put the young Whinchat in, but the Cuckoo made no attempt whatever to throw it out. I left home on this date for Grange-over-Sands.

On writing from Grange to one of my daughters, asking if she would see if the young Cuckoo were still in the nest, she replied that it was, and was more pugnacious than ever; when she went near the nest it opened its mouth so widely that it reminded her "of the opening of a tin of salmon."

On June 23rd she informed me the Cuckoo was not in the nest, so probably someone had taken it away. It could not have been fully fledged at this age—about thirteen days. I had met a person with two dogs on June 13th, and one dog was evidently trained for finding birds' nests; and he asked at the time if I knew of any nest containing an egg or young of the

Cuckoo. He said it was some time since he found the last young Cuckoo, near where we were standing.

The last time I heard the Cuckoo's call was on June 19th. I did not hear it once at Grange from June 19th to the 26th. I spent a good deal of time on Baildon Moor during the week ending June 19th, and found many nests, with eggs, of species which are victimised by the Cuckoo, but did not find another Cuckoo's egg, although Cuckoos abounded in the immediate district; which is strange, if the Cuckoo lays as many eggs as it is reputed to do by some authorities.

NOTES AND QUERIES.

AVES.

"An Unknown Warbler in Oxfordshire."—I have lately been reminded of the strange experience which I recorded in the article named above ('Zoologist,' 1903, p. 343) by reading Mr. H. Eliot Howard's 'British Warblers,' and especially his account of the Garden-Warbler. The mystery of the unknown Warbler has never been solved; but I have for some time had a strong opinion about it, and in the light of Mr. Howard's researches the story is worth a momentary revival.

The peculiarity of the bird was the song, which was utterly strange to all who heard it. It was a sweet, continuous, liquid gurgle, interrupted now and again by notes, usually three in number, of a more distinctly musical type, which have a certain mellow but reedy tone, not unlike some of the notes of the Redstart. The bird was carefully watched for three suceessive years in a wood some four miles from Oxford: in 1901 by Mr. W. S. Medlicott and a friend, in 1902 by the same good observer and nest-finder, who introduced me to it on June 10th of that year, and in 1903 by myself and several younger friends, all of them keen on finding a nest. But no nest was ever found that could be attributed to it in any of these three seasons.

The appearance of the bird, so far as we could see it in the rather dense foliage, was on the whole that of a Garden-Warbler, though the song seemed to forbid the identification. Nevertheless, I am now pretty well convinced that it was an eccentric member of this species, and for the benefit of future explorers of the 'Zoologist' I wish to give my reasons for this conclusion.

1. In listening carefully to the song of Garden-Warblers I have often heard something very like the notes, usually three in number, on which I laid stress in the extract given above, and have been instantly reminded of the mystery. Thus I have come to believe that the bird was a Garden-Warbler with an abnormal or deformed voice organ.

2. Assuming the song to have been an abnormal one, we have an explanation of the strange fact that, so far as we could see, the bird had no mate, and for the other curious fact that no nest was found in the course of three seasons, in spite of constant searching by experienced nest-finders. Could a female Garden-Warbler be expected to take up with a male who had nothing better to offer her in the way of song than this extraordinary performance?

3. The time of arrival, the second week in May, suits the Garden-Warbler better than any other bird which it is likely to have been.

4. Its use of its "territory" was quite in the manner of the Garden-Warbler as described by Mr. Howard. It wandered about the trees in an area of some two acres in extent, and specially affected one particular tree, an oak overhanging a small pond.

5. Its favourite food seemed to be green caterpillars—a characteristic preference, I believe, of the Garden-Warbler.

Thus I am now pretty well convinced as to its identity. But in any case, there is a very interesting feature in the story. For three successive years an individual bird returned to the same wood, taking possession of the same territory, and holding it during the season. This is made absolutely certain by the abnormal and unique song. And during those three seasons a number of good nest-finders utterly failed to discover a nest, which shows how pathetically persistent were the efforts of this unlucky bachelor to secure a mate who never came.—W. Warde Fowler.

Rough-legged Buzzards in Suffolk and Norfolk.—The two Rough-legged Buzzards, of which Mr. Rope had so favourable a view ('Zool.,' 1915, p. 466), would seem to have been one contingent of a migration of this autumn visitant, as two were also shot in the north of Suffolk on November 4th and 20th, 1915. These were forwarded to Mr. Saunders and Mr. Gunn, from whom I heard of them, as well as of others, in Norfolk. The first to come to Norfolk were two seen by Mr. J. Vincent, passing over a large Broad as early as September 27th. Being carefully protected, they continued to frequent the same neighbourhood until December, and up to the 16th of that month had been seen by him practically every day. During October and November, Buzzards, which are believed to have been all of the Rough-legged species, were seen or shot in various parishes as far apart as Breydon, Ormesby, Rollesby, Filby, Heydon, Hanworth, Northrepps, Hempstead, Long-Stratton, Snettisham, and Mundford, and one near Norwich. Possibly, however, some were counted twice over.—J. H. Gurney (Keswick Hall, Norwich).

Hornbill's Procedure in Bathing.—I recently watched an African Hornbill (*Ceratogymna atrata*) bathing at the Zoo in one of the small basins (about a yard across) in the Eastern Aviary. The bird repeatedly flew across this, dragging its tail and belly through the water, and, on landing, flapped several feet along the ground like a wounded bird. After a dozen or more repetitions of this, its plumage was so draggled that it had to scramble up the wires to get on a perch. What I

should like to know is—Does this mean that in nature this species plunges into deep water and flaps along the surface instead of bathing in the shallows, as land-birds usually do? The habit seemed to me a very risky one, but maybe the birds know safe bathing-places. —F. Finn.

Display of Wilson's Bird of Paradise.—On a Sunday in late autumn last, although the weather was dull, some Birds of Paradise were displaying well at the Zoo, and in particular I noticed the "show" of *Schlegelia wilsoni*, which was new to me. After hopping about actively in a horizontal pose, he drew himself up and bent down his neck, fully displaying his bald blue head and yellow tippet. Then he turned round and held his head up straight, equally well displaying these beauties and also the crimson back; again turning, still with the head up, he displayed his dark-green breast, thus fully exhibiting the variety of rich colours, in which this species excels all the others. The hen took no apparent notice.—F. Finn.

MOLLUSCA.

Catalogue of Sussex Mollusca.—My attention has been recently directed to three papers, of which I was unaware when compiling the catalogue of Sussex Land and Freshwater Mollusca ('Zool.,' 1915).

(1) By Messrs. Santer Kennard and A. W. Stelfox, "On the Occurrence in England of *Valvata macrostoma* (Steenbuch)," read at a meeting of the Malacological Society on March 11th, 1910 (see 'Proceedings,' vol. ix, Part II, June, 1910, p. 123). It records that Mr. Stelfox found this species in the Pevensey Marshes in 1909.

(2) By A. W. Stelfox on "The Occurrence of *Helicella heripensis* (Mabille) in Great Britain," read at a meeting of the Malacological Society on January 12th, 1912 (see 'Proceedings,' vol. x, Part I, March, 1912). It records the finding of this species by the author at the Devil's Dyke, and near Duncton in 1908, and at Lewes in 1911.

(3) By A. W. Stelfox, "Notes on some British Non-marine Mollusca," read at the Malacological Society on the same day as the preceding. It records that the late Mr. P. Rufford first collected *Planorbis vorticulus*, in a recent state, in Pevensey Level in 1908; that Mr. Stelfox found *Valvata macrostoma* in the marshes near Stoneham Farm, east of Lewes in 1911, and also *Paludestrina confusa* in a tributary of the Arun, at Bury (a hamlet near Amberley Station) in 1908, and again in 1911.

The last paper contains a most excellent photograph, by Mr. R. Welch, of all the species above mentioned, with others.

I much regret the unfortunate omission of these records from the catalogue.—E. W. Swanton (Educational Museum, Haslemere).

Slipper-Limpet in Essex.—Mr. G. C. Robson ("On the Extension of the Range of the American Slipper-Limpet on the East Coast of England," 'Ann. and Mag. Nat. Hist.,' pp. 496–499, 8th Ser., vol. xvi, December, 1915) has recently drawn attention to the spreading of the Slipper-Limpet (*Crepidula fornicata*) on certain portions of the coast. It will therefore be of interest to point out that whilst on a dredging expedition at Walton-on-the-Naze, Essex, on October 27th, 1915, I obtained four living examples of this mollusc, two of which, attached to an empty shell of a Whelk, are at present (January 12th) to be seen in one of the public aquaria of the Horniman Museum at Forest Hill. The Slipper-Limpets were all obtained at one place, about a mile and a half down the irregular arm of the sea which extends from the old mill at Walton towards the open water. I have spent several days at different times of the year in dredging at Walton, but had never before obtained the Slipper-Limpet. The boatman informed me, when I drew his attention to the molluscs, that he was already aware that Slipper-Limpets were to be found in the neighbourhood.—H. N. Milligan.

ANTHOZOA.

Sagartia parasitica Mounting on Shells.—On the afternoon of October 22nd, a small so-called Parasitic Sea-Anemone (*Sagartia parasitica*), of about half an inch in length, was dropped into an aquarium. It fell close to a small Hermit-Crab (*Eupagurus bernhardus*) enclosed in a *Nassa* shell. A few seconds later it so happened that the Hermit-Crab dragged its shell past the Sea-Anemone, and the latter adhered to the pointed end of the *Nassa* shell by means of its disc and tentacles, and it was dragged behind the crustacean. The Sea-Anemone quickly bent its column, in a way which was suggestive of the action of a looping caterpillar, so that it was able to press a portion of its base on the shell, and by this part of its base it adhered. The disc now released its hold of the shell; the remainder of the base was pressed on the shell; and then the column of the Sea-Anemone was raised so that it stood obliquely out from the shell in the characteristic manner of this cœlenterate. This process occupied not more than five minutes, though I neglected to note the exact time taken. In order to observe whether the Sea-Anemone would repeat the action, I

removed it from the shell, placed it on the floor of the tank, and then pushed the Hermit-Crab and shell towards the cœlenterate. The latter turned its disc towards the shell, but unfortunately the Hermit-Crab at that moment scuttled away. I then placed an empty whelk-shell, of about two and a half inches in length, against the *Sagartia* in such a way that the point of the cone almost touched the Sea-Anemone. The latter proceeded to mount on the point of the shell, again fastening itself first by its disc, and then affixing its base. In this case the time occupied was taken by the watch. The whole process, from the moment of placing the shell to the time when the *Sagartia* stretched its column up from the shell, occupied ten and a half minutes.—H. N. Milligan.

EDITORIAL NOTES.

Mr. G. Bathurst Hony writes from 4, Beaufort Road, Clifton, Bristol: "As I am working at the Natural History of Wiltshire, I should be greatly obliged if your readers would send me any information they can on the distribution, etc., of fishes, reptiles, and amphibians in the county. Any other notes on the natural history would be welcome."

No doubt many of our readers will be able to oblige, but, as we remarked on a similar occasion a year ago, it would be as well to send such notes to the 'Zoologist,' such copy being always required, while the publication of an observation is likely to result in the acquisition of further evidence.

We should also like to draw attention to the recent amalgamation of our publishers with Messrs. Adlard and Son, of Bartholomew Close. Messrs. Adlard are an even older firm than West, Newman & Co., dating back 150 years, and we feel confident that, with the added benefit of their valuable experience and, we hope, an increased support from subscribers, the 'Zoologist' will attain an importance beyond anything in its past. In this confidence we wish our subscribers and contributors a prosperous New Year.

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ICTERINE WARBLER FROM TUSKAR ROCK.

PHOTOGRAPH OF THE BIRD IN THE FLESH AFTER IT WAS REMOVED FROM THE SPIRIT AND ITS FEATHERS DRIED. ABOUT ONE-SEVENTH LARGER THAN NATURAL SIZE.

Photo by C. J. Patten.

THE ZOOLOGIST

No. 896.—February 15th, 1916.

ICTERINE WARBLER ON MIGRATION OBTAINED ON TUSKAR ROCK. WITH REMARKS ON THE STATUS OF THIS SPECIES IN THE BRITISH ISLES.

By Professor C. J. Patten, M.A., M.D., Sc.D.

In the February number of the 'Irish Naturalist' for 1915, p. 42, I published a preliminary note to the effect that I had received and identified an Icterine Warbler (*Hypolais icterina*), taken at Tuskar Light-Station, Co. Wexford. The bird was picked up dead on the rock at 7 o'clock a.m., on Wednesday, September 2nd, 1914, by Mr. Glanville, Principal Keeper. He knew that it was a strange bird, and I am deeply indebted to him for his care in preserving it in spirit for me until I returned from Australia seven weeks later. The following is an account of its bodily condition after I had removed it from the spirit and dried its feathers: Emaciation had proceeded to an advanced degree; the muscles were flabby and greatly wasted, the breast-bone was sharp and prominent, and all traces of adipose tissue had disappeared. The specimen weighed only 1 dr. 34 gr., having become reduced to about one-fourth of its normal weight. As the bird was in a rather poor state of preservation, many feathers over the rump and on the abdomen coming away on patches of peeling epidermis, and as the eyes were sunk in their sockets, one would have surmised that it had lain dead on the rock for some days before it was picked up. However, Mr. Glanville tells me that, in his

opinion, it had been dead probably not longer than the previous night, adding that the weather was very warm at the time, and that the bird when he picked it up was apparently quite fresh. Assuming this to have been the case, it would appear that rapid decomposition must have set in very shortly after death, a state of affairs which I have noted in the case of several other emaciated birds obtained from light-stations.* The spirit in which the bird was immersed somewhat failed to fix the disintegrating skin adequately, hence the peeling of the epidermis above mentioned. Supposing, then, that this bird had been dead only since the previous hours of darkness, the inference that it struck the lantern and fell on the rock (killed outright or mortally wounded, so that it died before daylight) is exceedingly unlikely. And for two cogent reasons: Firstly, because of its starved condition, the wing-muscles in particular having undergone marked atrophy. For, having made post-mortem examinations on some hundreds of birds which met their death by striking the lantern, I have never found them—or at most with very rare exceptions—in any other than excellent condition, far fatter than when procured from their sheltered *natural habitat* at an intermigration period of their existence. Indeed, the accumulation of reserve adipose tissue, which is to be found on migrating birds, forms quite a remarkable and an interesting feature. And this holds good for rare migrants as well as for those which visit the lanterns regularly in abundant numbers.† Secondly, because there were no signs whatever of injury on the body, whereas birds which collide with the lantern‡ almost invariably display marks of violence, oftentimes extensive in character.

* Fat birds invariably keep better than emaciated ones, often resisting decomposition for a very considerable time, and fat small birds when soaked in spirit for some days will keep almost indefinitely.

† *Vide* my articles on "Asiatic Skylark on Migration," 'Zoologist,' September, 1913, pp. 333–336; also "Aquatic Warbler on Migration," *ibid.*, March, 1915, pp. 81–92.

‡ Owing to the swiftness of flight and the small resistance which such a thin medium as air offers, birds are liable to damage themselves badly should they collide with any resisting object. I have examined many birds which lost their lives through striking telephone-wires, flagstaffs, weather-cocks and other objects on pinnacles, and found great lacerated wounds and extensive fractures of limbs, beak, and skull.

On the morning on which the Icterine Warbler was picked up, the weather happened to be fine, though somewhat misty. Furthermore, it was calm, the wind only registering the force of a gentle breeze according to Beaufort's scale. Nor did the meteorological returns show that a rough phase of weather had existed during the days immediately preceding. From this important point in the analysis of the weather report we may argue *a fortiori* that the bird was not driven by rough weather and high winds to alight directly on Tuskar Rock, only to die almost immediately after its arrival. I have seen many storm-driven birds alight on this rock when I resided there for the purposes of studying bird-migration. They, for the most part, arrive in daylight during a gale. They generally appear to be in good condition and vigorous, and move about on the rock in as lively a manner as the rough weather will permit. They tell us, as it were, that they have not been carried far out of the course from whence they started, or, at all events, from their last halting-site *en route*.* And such birds generally manage to get away clear when the wind abates, and even in the event of being detained for a considerable period through adverse weather, they may, at any rate in the warm months of the year, eke out a precarious subsistence for a while on flies attracted to the rock by the lightkeeper's victuals or by decaying sea-weeds or other refuse. But owing to the difficulty in obtaining fresh water † and the absence of shelter afforded by wood or glade, these little land-birds soon begin to part with their vigour on the bleak marine rocks, and, in their eager endeavours to move away, find themselves becoming so deprived of wing-power that they are unable to effect other than local trips. Hence we find them, shortly after setting out, alighting again on the nearest vantage-ground—namely, another rock—and this movement is repeated until having visited two or three of these inhospitable retreats the waifs eventually succumb. Now I believe that the Icterine Warbler, which forms the subject-matter of this paper, comes under the category of a

* I have good reason for believing that many of the smaller land-birds, in making long journeys, draw up to rest and refresh themselves several times *en route*.

† The fresh water for human use is conserved in tanks with closed lids.

migration waif, which, separated from its companions, had drifted aimlessly, and then becoming fatigued, was forced to alight; and it is likely that it made more than one attempt to reach the goal of its destination. Originally, of course, it may have been wafted from its accustomed migration route by stress of weather; however, there is little reason to doubt that it had sojourned at other rock-islands before it arrived on Tuskar, its last resort, where, in a starving state, it died a few days, or perhaps only one day, subsequent to its arrival. Had the bird been perambulating for any length of time alive on the rock, I feel quite sure that Mr. Glanville would have detected its presence, for few birds have escaped his sharp eye, and I know that, over and over again, he has proved himself, aided by his telescope, capable of identifying many of the small and sombre-plumed Warblers. From the written observations which he has very carefully compiled and kindly forwarded to me, it would appear that no birds visited the lantern on the night preceding the morning on which the Icterine Warbler was discovered. Furthermore, except for the presence of some Wheatears and a few Dunlins at the lantern on August 31st (two of the latter being found dead on the rock on the morning of September 1st), no migratory move was witnessed since August 16th, when Wheatears, Willow-Warblers, Sedge-Warblers, Spotted Flycatchers, a Pied Flycatcher, and a Corn-Bunting were identified at the lantern. The only other birds which Mr. Glanville observed on the rock at the time when he picked up the Icterine Warbler were two Yellow Wagtails; both were vigorous and winged their way westward after a halt of half an hour. All these points indicate that this Icterine Warbler probably arrived on the rock *alone*, or, at the most, it may have fallen in with a few passing diurnal migrants. It may be suggested that it accompanied the muster of birds which appeared round the lantern on August 16th, that it was then vigorous and fat, but having become slightly injured, it remained on the rock for a fortnight, when it died. But this notion may be dismissed when we remember that the bird was on no occasion seen alive by Mr. Glanville, and it should be borne carefully in mind that injured birds, as they gradually grow weaker and lose vigour, become consequently much tamer, and

so betray their presence to a remarkable degree. Moreover, as before mentioned, there was absolutely no mark whatever on the body to indicate that the bird had struck the lantern.

In regard to the particulars which I made out from an examination and a dissection of the body, in addition to the general bodily condition already described, they are as follows: Total length, 12·8 cm.; wings, 7·62 cm., both being of the same length; bastard primary, 1·1 cm.; tip of wings to tip of tail, 1·4 cm.; tail, 5·5 cm.; feet, 2·2 cm., leaden-colour, toes similar, nails dirty white in colour; beak, 1·1 cm; almost the entire lower segment, light yellowish-brown in colour; the upper segment, brownish. Weight, 1 dr. 34 gr. Condition, markedly emaciated. Sex, female. Age, immature. Plumage, first autumn, bright and clean. Gizzard, quite empty.

Summary of Previous Occurrences of the Icterine Warbler in the British Isles.

This Icterine Warbler from Tuskar Rock is the first of its kind which has been procured from an Irish light-station, and is the second Irish specimen which has been authentically recorded. The first bird was collected as long ago as June 8th, 1856, at Dunsinea, Co. Dublin, by Mr. J. G. Rathborne, who presented it to the National Museum, Dublin, where it is now preserved.* Fifty-eight years and three calendar months less six days therefore elapsed between the capture of these two Icterine Warblers. Nevertheless, the great rarity of the species in Ireland must not be regarded as absolutely conclusive on the mere evidence of only two birds being obtained at very long intervals. Reference to this point will be made again more fully, in dealing with the status of the species as an Irish bird.

The occurrences in Great Britain, though by no means numerous, are much more so proportionately than those which have taken place in Ireland. They are as follows: One obtained near Dover, Kent, on June 15th, 1848; one obtained at Blakeney, Norfolk, on September 11th, 1884; one obtained at Newcastle-on-Tyne, Northumberland, on June 20th, 1889; one

* Ussher, 'Birds of Ireland,' 1900, p. 23.

obtained at Holderness, Yorkshire, on May 28th, 1891; one obtained at Wells, Norfolk, on September 4th, 1893; one obtained at Cley, Norfolk, on September 7th, 1896; and one obtained at Burwash, Sussex, on April 30th, 1897. The above instances are taken from Saunders's 'Manual of British Birds,' second edition, 1899, p. 75. The following occurrences have been recorded after the publication of Saunders's manual: One obtained at Cromer, Norfolk, on September 5th, 1899 (E. C. Arnold, 'Zoologist,' 1899, p. 475); one obtained at Blakeney, Norfolk, on September 18th, 1903; and one seen on September 26th, 1905 (J. H. Gurney, 'Zoologist,' 1904, p. 209, and *ibid.*, 1906, p. 134); one seen by Mr. A. Napier, near Holkham, Norfolk, on September 20th, 1903 (J. H. Gurney, 'Zoologist,' 1904, p. 212); one seen at the Kentish Knock Lightship on September 22nd, 1903 (W. Eagle Clarke, *ibid.*, 1904, p. 136); one, a male, obtained near Rye, Sussex, on June 26th, 1905 (J. B. Nichols, 'Zoologist,' 1905, p. 349); one, a female, obtained at St. Catherine's Lighthouse, on September 29th, 1905 (H. F. Witherby, 'Bulletin of the British Ornithologists' Club, vol. xvi, p. 23). The above instances have been gleaned from a paper in 'British Birds,' vol. i, p. 83, by Mr. Witherby and Dr. Ticehurst, entitled, "On the more Important Additions to our Knowledge of British Birds since 1899." Still later notices of the occurrences of this Warbler in Great Britain are as follows: One obtained at Cley, Norfolk, on September 12th, 1907 (E. C. Arnold, 'British Birds,' vol. i, 1907–8, p. 226); one obtained at Fair Isle in autumn, 1908 (W. Eagle Clarke, 'Annals of Scottish Natural History,' 1909, p. 73); one obtained at Lerwick, Shetland, on May 15th, 1910 (G. W. Russell, 'Annals of Scottish Natural History,' 1911, p. 183); one, a female, obtained at Wells, Norfolk, on September 13th, 1911 (F. Penrose, 'British Birds,' vol. v, 1911–12, p. 188); three recorded at Fair Isle, between June 3rd and 5th, 1911 (W. Eagle Clarke, 'Studies in Bird Migration,' vol. ii, p. 133).

N.B.—These last three records from Fair Isle are chronologically earlier than the record made by Mr. Penrose for Wells, Norfolk, but were published at a later date. One recorded at Fair Isle on August 5th, one on August 10th, two on August 21st, and one on August 22nd, 1912 (W. Eagle Clarke, 'Scottish Naturalist,'

1913, p. 28); one recorded at Fair Isle on May 26th, 1913 (W. Eagle Clarke, 'Scottish Naturalist,' 1914, p. 54); one, an immature male, obtained at St. Leonards-on-Sea, Sussex, on August 26th, 1914 (H. W. Ford-Lindsay, 'British Birds,' vol. viii, 1914–15, p. 146); two, a male and a female, obtained at Pentland Skerries, Orkney, on June 10th and 11th, 1914 (J. Bain, 'Scottish Naturalist,' 1914, p. 237); one obtained at Fair Isle, on June 11th, 1914 (W. Eagle Clarke, 'Scottish Naturalist,' May, 1915, p. 104). The sex of the last bird—viz. a female—is given in the 'Report of Scottish Ornithology in 1914,' in a conjoint paper written by Miss Baxter and Miss Rintoul ('Scottish Naturalist,' July, 1915, p. 195).

N.B.—The records from Orkney and the most recent from Fair Isle are chronologically earlier than the records made by Mr. Lindsay for Sussex, but were published at a later date.

It may be seen from the above statistics for Great Britain, that during a period lasting sixty-six years—viz. from 1848, when the first bird was obtained, to August, 1914, when the latest bird to date was obtained—thirty-one examples have been duly recorded, all of which, with the exception of three, have been handled and identified beyond doubt.

In Ireland we have seen that only two authentic records have been made during a period of fifty-eight years and almost three months, *e.g.* from June, 1856, when the first bird was obtained, to September 2nd, 1914, when the second and only other bird known at present was procured.* Taking all the records for the British Isles, thirty-three in number, we find that the first bird was obtained at Dover in 1848, the latest to date at Tuskar Rock on September 2nd, 1914.

Status of the Icterine Warbler as a British Bird.

Following the line of argument which I have adopted in regard to the status of the Aquatic Warbler as a British Bird†—

* Excluding the record of a bird seen by Rev. A. Ellison on May 29th, 1886, at Coollatin, Co. Wicklow, and believed to have been an Icterine Warbler; but this bird was not brought to hand.

† *Vide* my article on "Aquatic Warbler on Migration, obtained on Tuskar Rock," 'Zoologist,' March, 1915, pp. 82–92.

a line of argument applicable in considering the status of many other birds which visit us—it is true that, while the Icterine Warbler may be classed as a rare visitor to our Isles, it has, nevertheless, been overlooked to a considerable extent, and its greater rarity, as disclosed by the earlier records, has been apparent rather than real.* The greater frequency of the appearance of the bird in latter years, as compared with the more lengthened periods which elapsed between the dates of occurrences of the earlier specimens, notably between the first and second, depends largely upon the fact that, not only has the study of ornithology found more favour of late, but also that many more workers have made a special study of migration, and have selected the very best types of observatories—I mean light-stations built on rocks or small islands some miles off the coast, and situated so as to lie along and often to intersect important migration-routes. Now, apart from the fact that the lighthouse is a very great asset, in that it attracts birds, it is also highly important to note that, whether these birds descend from the lantern at night to the rock, as I know many undoubtedly do, or alight in daylight *independently of the existence of the lantern*, owing to the small compass of ground, bleak and devoid of foliage and other natural cover, it is a difficult matter for a migrant, when it arrives, to escape betraying its whereabouts; even when in hiding in a rock crevice it can with ease be dislodged and made repeatedly to show up at these excellent observatories. Obviously it is more difficult to make sure of the identity of birds which touch on the mainland, for should they not take wing at once, they quickly make for cover, through which they can thread their way for long distances without being dislodged. And so, outstripping the range of the observer, they soon become lost in the interior of the district.

* Saunders regarded the Icterine Warbler as "only a very rare visitor to England and Ireland," it being, at the time he wrote, as yet undiscovered in Scotland. I should suggest modifying his sentence somewhat as follows: A visitor on passage in small numbers during the spring and autumn migrations to the southern and eastern seaboards of Great Britain, and probably occurring annually. Seemingly much rarer in Ireland, and occurring probably as a westward straggler from its regular migration fly-lines. Has in all likelihood been overlooked to a greater extent proportionately than in Great Britain.

As an example of the good work that is being carried out at light-stations, that which is being prosecuted by Mr. Eagle Clarke stands out prominently. Before this zealous ornithologist took up the studies of migration on Fair Isle, not only was the Icterine Warbler unknown in Scotland, but, if we allowed ourselves to be guided solely by records, it would seem that the species showed a preference for the section of Great Britain which lies between the counties of Norfolk and Sussex. But from a study of its geographical distribution,* there is no valid reason on the bird's part to show why it should confine itself in the main to this circumscribed area when touching on the British coast. The bird was recorded more often here than elsewhere doubtless because there were relatively more observers. But that the Icterine Warbler has passed along a considerable part of the eastern seaboard of Great Britain is shown by the capture of a specimen in Yorkshire and another in Northumberland. If to these we add the records of its visits recently made to Orkney and Shetland, we find that its British distributional area on migration is very wide; occupying in fact, the extreme length of the eastern seaboard from Dover to Shetland. And no doubt the gaps, still existing, in the bird's occurrences between Northumberland and the north of the Scottish mainland are only apparent, and will be filled up by records of *actual* specimens obtained as time goes on; indeed, it is no mere hypothetical idea to assume that this Warbler has already more than once visited intermediate points on the eastern sea-coast of Scotland. Such visits to our coastlands are to be expected, even though they be in small numbers, for the birds which reach us are regular members of the western fringe of migrants, which, without any undue detachment from the main body, pass up annually far beyond our latitudes to breed in Scandinavia, penetrating into the Arctic circle in Norway. A glance at the general geographical distribution † of the Icterine Warbler, as it pushes north to breed, shows that, *inasmuch as it is common within sight of our shores—e.g.* in parts of France, Belgium, and Holland—it can hardly avoid touching the east coastlands of Great Britain; and so it is fair to put forward the argument that the bird has been largely overlooked. Furthermore, we cannot

* *Vide* p. 53. † *Ibid.*

regard the bulk of the actual occurrences as representing those of mere autumn, immature, inexperienced, straggling birds, carried westward by adverse weather, because this species has occurred many times both on its vernal and autumnal migrations, and in vigorous condition.

Mr. Eagle Clarke's discovery of the Icterine Warbler on Fair Isle is highly interesting, not only because he shows us that the bird "has occurred annually on the island during recent years in spring or autumn or both," * thereby making its periodic status in all likelihood that of an annual visitor on passage in spring and autumn, but also because he shows us that the bird, when affecting migration-phases lasting several almost consecutive days, made its appearance on some of these days in the plural number, proving conclusively that it cannot be a mere accidental wanderer. And the appearance of two Icterine Warblers, a male and a female, almost synchronously at Orkney, fortifies this last argument. The complete status of the bird, therefore—periodic and numeric—as far as Fair Isle is concerned, might read somewhat thus: An annual visitor on passage in spring and autumn in small numbers; but at the same time I wish to point out that I have founded this status for the Icterine Warbler at Fair Isle with all due deference to Mr. Eagle Clarke's opinion, for it is he who has furnished us first-hand with the interesting data, having conducted his investigations personally. I desire merely to generalise as the result of a very keen interest taken in this point. I am fully in accord with Mr. Eagle Clarke's remarks, that the "species largely escapes notice as a bird of passage along the British shores." †

The extreme paucity of records of the bird's occurrence in Ireland—only two in all—as compared with those not only of England but also of Scotland, is somewhat puzzling. Undoubtedly the disproportion is, to a large extent, to be explained by the fact that workers in the field of Irish ornithology have, all along the line, been lamentably few. As seen, the records extend over very long intervals of time; albeit from this fact alone, one must not, as before stated, hastily conclude that

* "Notes on the Migratory Birds observed at Fair Isle in 1914" ('Scottish Naturalist,' May, 1915, p. 104).

† *Ibid.*

in Ireland the bird is extraordinarily rare. But it does seem strange, however, that, in comparatively recent years when work at Irish light-stations has been receiving such special attention, no other specimen, save the one which I have been sent, has been recorded from a light-station. One hardly can expect to carry much conviction by advancing the argument that the sombre plumage of the Icterine Warbler and its close resemblance to a large Willow-Warbler diminished its value in the eyes of the light-keeper to such a degree that he did not consider it worth his while collecting and forwarding it for identification, especially when we remember that its near ally, the Melodious Warbler, very like it in plumage, together with several other rare plain-coloured Warblers, has been obtained, as recorded by the late Mr. Barrington.* Still, there may be something to be said in favour of the argument that, when a rare species bears a close resemblance to a very abundant species, the former is apt to be, at least occasionally, cast aside as of no value. A case in point is to be found in that of the Meadow- and Tree-Pipit. No doubt the latter must have been quite overlooked until I pointed out to the Tuskar keepers that, omitting minor details, the only main distinction was to be found in the difference in the length and curve of the hind-claw, and that the foot of every Pipit captured should be submitted to a very careful examination. Since 1912, when I first discovered the Tree-Pipit at Tuskar Light-station, Mr. Glanville, who is greatly interested in the differential diagnosis of species, and to whom I pointed out the differences in the two species as I held the actual dead birds in my hands, has sent me evidence to show that the Tree-Pipit has occurred at that light-station annually since its discovery. All the same, it is natural that the brighter and more definitely-coloured and varied-plumed birds would run less risk of being overlooked by the light-keepers. But to return to the point in particular regarding the rarity of the Icterine Warbler in Ireland: there is one

* The records of rare Warblers and other birds from Light-stations, sent to the late Mr. Barrington, have been published by him from time to time in the pages of the 'Irish Naturalist' and other periodicals. They are conveniently summarised and afford a ready reference in the December number of the 'Irish Naturalist' for 1912, p. 233.

question, however, which, by way of trying to elucidate the matter, may be put forward, namely, What is the behaviour of the Icterine Warbler at the lantern? Does it, like the Whitethroat, Sedge-Warbler, and many other species, *strike* in the strict sense of the word, making a loud tap on the glass, and thereby arrest the attention of the light-keeper so that he goes out on the balcony and picks up the specimen at once? or does it come in quietly, like a Robin or Goldcrest, and then flutter up and down the glass, disappearing in a short time by descending to the rock or elsewhere? or does it, on reaching the lantern, skulk, after the fashion of a Grasshopper-Warbler or a Wren, on a window-sash, hand-rail, or other perch during the hours of darkness? For if it in a characteristic manner adopts any other than the first measure, it is much more likely to escape being captured by the keeper, whose duties on his watch prevent him from always being on patrol out on the balcony. From personal observation I have ascertained that different species behave very differently when under the influence of the luminous beams.* But, lastly, let us remember that, on the other hand, while granting that the bird must have been overlooked, not only at light-stations but also on the mainland because of the inadequate numbers of contemporaneous workers always in Irish ornithology, it may yet be proved, should ornithology ever be studied more extensively in Ireland, that the western limits of the Icterine Warbler's migrations are, like those of the Nightingale, sharply marked off, in other words, that they are strictly adhered to, and that Ireland, lying beyond—*i. e.* west of the fly-lines—is, in reality, very exceptionally visited, most probably by stragglers wafted out of their course. Finally, as above mentioned, the Icterine Warbler received from Tuskar Rock was certainly a waif; but in regard to the first bird, taken in June, 1856, while we have no account of its bodily condition at death, of the contents of its gizzard, of its weight, and of other important details, albeit the idea of its being a straggler is strongly negatived by the fact that

* *Vide* my articles on "Wrens on Migration," etc.; "Grasshopper Warblers on Migration," etc.; "Spotted Flycatchers on Migration," etc. ('Irish Naturalist,' 1912, pp. 125 *et seq.*, 137 *et seq.*, and 193 *et seq.*; also "Diurnal Migrations," etc. 'Zoologist,' 1913, pp. 217 *et seq.*)

it was in splendid song at the time that it was obtained. "It rose up from some willows after the manner of Flycatchers, and returned singing to the branch again" (Ussher, 'Birds of Ireland,' pp. 23, 24). It evidently was vigorous.

General Geographical Distribution.

With respect to the general geographical distribution of the Icterine Warbler, Saunders states: "In Norway the Icterine Warbler breeds up to a little beyond the Arctic circle, although in Sweden, Finland, and Russia its northern range is less extensive. Eastward, the Ural and the valley of the Tobol form its known limits, while further south it has been obtained at Lenkoran, on the western side of the Caspian. In Asia Minor, and south-eastern Europe as far as Malta, it is only known on its migrations to and from Africa—where it winters down to about 25° S. lat.; but in Sicily and on the mainland of Italy, where it arrives in April, it remains to breed; though Sardinia and Corsica are seldom, if ever, visited. In Central and Northern Europe, up to the Baltic Provinces, Denmark, Germany, Holland, and Belgium, it is common from the middle of May until autumn. In the north-east of France it is very abundant, and extends westward as far as the valley of the Seine, in and beyond which is found the next species, *H. polyglotta*,* often confounded with our bird both as regards specimens and nomenclature. The Icterine Warbler appears to be rare in Savoy and unknown to the westward. Both species meet in Tunisia."

* It is interesting to note that *H. polyglotta*, the Melodious Warbler, a species closely-allied to the Icterine Warbler, and a bird which does not penetrate nearly so far north in Europe, the limit of its range being Normandy, north of which it only occurs as a mere straggler, has been taken a few times in the south of England, and once in Ireland, in Co. Cork. All these records are of recent date.

A DIARY OF ORNITHOLOGICAL OBSERVATION MADE IN ICELAND DURING JUNE AND JULY, 1912.

By Edmund Selous.

(Continued from vol. xix, p. 307.)

June 27th.—To-day, for the first time, I saw a Phalarope making that peculiar whirligig motion on the water which is said to constitute its nuptial or courting display. The particular bird thus acting when, at about seven in the morning, I looked out of my tent, was by itself, or, at any rate, there was no other one that I could see very near it. I hastily got hold of the glasses, but before I could get them properly focussed on the bird, it had left off. Annoyed at this, I continued to watch it perseveringly, and my perseverance was rewarded, for after some time had gone by, it began again, going round like a top, without changing its place on the water. Once or twice it varied the motion by jerking itself from side to side only, and then I thought I must have exaggerated the rotary one, but hardly had I begun to doubt when this was indulged in, again, as markedly as before. It was most extraordinary, and did not appear to me to have anything of the character of a display action, but suggested much more some form of nervous derangement such as the Dancing Mouse of Japan may be supposed to suffer from. Later, either this same bird or another flew over to the mouth of the little stream I have mentioned, and gyrated gradually up it—but there were, of course, swimming intervals. When he got out of sight I began to follow him, and it then appeared that he was accompanied, though I had not seen the partner bird before. I soon had the satisfaction of seeing them both waltzing in this bizarre manner, separately, indeed, but often near to one another. On two of these occasions one of the revolving birds seemed to think the proximity too close a one, for it flew at the other, who flew a

little farther away, when both began to spin round again. I think it was the same bird that, each time, made the aggressive movement, but, as I could not observe any difference of size or coloration between them, I do not know whether it was the male or the female. I thought they must be of the same sex, but when one flew away the other followed, which suggested the nuptial tie. Whilst rotating in this peculiar way the birds, from time to time, pecked up something from the water which of itself might suggest that the motion is in some way related to feeding. The water just here is quite shallow, and once I am sure I saw one of the birds either standing or with its feet just touching the bottom. In this way, if they continued to do so during the actual gyrations, mud or weeds would be stirred, and this would be likely to bring minute aquatic creatures to the surface. The act of thus stirring the mud with its long dangling legs would send the bird round, and as soon as the motion had become a habit it would be practised anywhere, irrespective of food, though owing its origin to the attempt to procure this.

I could see but little of sexual activities amongst these Phalaropes, but sometimes there would be an aerial pursuit of one by another, and sometimes a flight of several, whether in the nature of so many little chases also I cannot say; it took place but seldom, and always at a considerable distance. Also one bird would sometimes fly over the water to another, who would rise and fly farther off just as this one was coming down. This, no doubt, was a nuptial touch, as with the Horned Grebes, as lately noted, and, indeed, with birds generally. The one sex seeks the other—usually the male the female—and an element of coquetry, or, let us say, erotic excitement, probably enters into the retreat of the latter. The only instance which I have yet seen of anything approaching imperiousness on the part of one sex towards the other, or that might be so interpreted, was when, as I have recorded, one of a hypothetical mated pair, that were both rotating, drove off the other on its coming too near. That was what it seemed. Assuming the correctness of the statement that the ordinary relations of the sexes are reversed in this species, and bearing in mind an observation made by Herr Mannicke in the case of the Grey Phalarope, the female may here have been trying to induce the male to fly to the shore

to the end that coition might be there effected, and this, it is obvious, though suggested by peckings, is compatible with a fair amount of conjugal affection and happiness. It had not, however, that appearance. The idea it conveyed was simply that one rotating bird resented the too near approach of the other. Moreover, I was unable to catch in these curious revolutions any of those characteristic features with which I am acquainted in the true sexual display of birds, nor did they appear to me to be at all well adapted for showing off the plumage. Certainly no detailed display of it was made by these movements, nor were they justified by the general effect, which did not, by any means, exhibit the bird to the best advantage. In fact, there seemed no relation between the movements themselves and such beauty of plumage as the bird possesses, and, having myself seen Dancing Mice, I was at once struck with the similarity between the two performances, both seeming pathological in their origin. That this irrelevant and inartistic little whirligig, however originating, has now come to be a sexual antic is, I think, quite probable, but I cannot believe that it has been developed along the true lines of sexual selection. As will have been seen, it differs entirely from anything that might be described as a circling dance of one sex around the other. Possibly we see in it the degeneration of such a one, but these birds, at any rate, circled round nothing but their own axis, and, when they stopped, it was difficult to think they did so for any other reason than because they were giddy. The degradation of something rather than its legitimate development is suggested to my mind. I timed the duration of these St. Vitus-like dances on two or three occasions, and found that they lasted just a minute. I am convinced that they were sometimes much longer, but a minute is a good time to keep spinning round like a top. I ought to have timed them oftener, but it is very tedious doing so, as it is quite impossible to say which is going to be a longer or shorter performance, just as in counting the number of claps of the wings above its back, given by the Nightjar. Perhaps, however, three times (I think it was three) is sufficient to show the average length. I am sorry that I have not begun to watch these birds, in a special manner, earlier. They have been squeezed out, as it were, by others that, perhaps, are less interesting. It would appear that,

in their case, the female is to the male what, according to the general rule, the male is to the female—in size, colouring and relative domestic habits, that is to say. But that is no evidence of the actual male being in a state of subjection to her, for the converse of this by no means represents what is ordinarily the case. That power belongeth unto the female, rather than the male, has indeed been more my experience. On the two occasions, when (as we will suppose) the male was ill-humouredly pecked at, he did not give me at all the idea of being under her tutelage. There was no sign of awe (save the mark!), he merely flew a little way off and went on feeding, as though very much unimpressed—just as a female Gull or Crow might have done under similar circumstances. "There, then, you old cross thing"—that was more the idea.

Though, owing to the predacious naturalist, I have been disappointed in not seeing the Icelandic Jer-Falcon, I to-day saw his handiwork—*viz.* the feathers, with the head and neck, of a male Mallard, lying on the river bank, as we came here. This exactly agrees with my experience of smaller findings in England —Starlings, Fieldfares, Finches, &c. The head, as I suppose, is in all cases pulled off before further transportal, for neither here nor elsewhere have I found anything but the feathers. Whether the victim is dead before its head is thus pulled off—whether this Duck was—would be all a chance. At any rate he must have been immediately afterwards; let the optimist think of that, not the process. Some of the details may be unlovely, but what would I not give to have seen the drama as a whole—the swoop and mighty rush of pinions down the darkening air, the fierce destruction and magnificent pose above the prey, the scattered feathers and triumphant bearing off of the plucked and decapitated body? (Detail again, but, outside humanity, I never would bowdlerise Nature.)

June 28th.—Whilst watching the Phalaropes, this morning, as they swam and caught Mosquitoes in the bay one flew towards another, and then, as by magic, the two became a little flock, which flitted about, for a minute or so, before coming down on the water, again. I say by magic, because at any distance these small birds are not easy to see, as they swim, so that when they rise from different parts (they do not feed closely)

and come together into a flock, it seems to have formed itself out of nothing. The first flight (remarked by me) was at 8, perhaps, and, at about 9.30, there was another one. They have a pretty appearance, owing to the glancing of whatever there is of white in their small bodies, and the motion, too, is soft and graceful.

Do Phalaropes dive? The answer, as given by the lobed toes, would seem to be Yes, but, looking at them, one would not think so. They do not seem sufficiently aquatic birds for that. Nevertheless they must, for one or other of them will, from time to time, disappear in a manner which does not allow of another explanation. One of a pair just now, for instance, that I had the glasses full upon, was, all at once, not there. But I have not yet succeeded in seeing one go down.

The little flights are now becoming more frequent. First one bird will make a little scud over the water, then another, and then, all at once, the whole of them—perhaps a dozen—and all sweep together and delicately skim away. One bird has just flown close up to another one on the water, this other, a moment afterwards, flying a few yards off, and coming down again. I do not know if a peck, administered, had anything to do with this, but it is not at all necessary to suppose so. I have only once, up to now (11.55 a.m.) observed anything of the rotary motion, on the part of one bird only, and then it was very undeveloped, and lasted only a few seconds.

Besides Phalaropes in the water are Whimbrels on the shore, and these seem to bear the former no good will, for one has just flown out over the water with a hostile demonstration above them, which, for a moment or two, seemed as if it would develop into an actual attack. One of them evidently thought that it would, and, conceiving itself to be threatened, gave a violent start on the water, the points of its wings flashing out unevenly, in a dishevelled manner. This might be taken as evidence that the Phalarope does *not* dive, or surely this frightened bird would have done so. The Whimbrel, however, only flew just over him, and a little beyond, and then returned to his coterie. It was a sort of threatening stoop and demonstration, but for what precise reason it would be difficult to say; I have, indeed, a suspicion that there was none, but this is only a provisional hypothesis.

There are, on this lake, which is long and narrow, two pairs of Whooper Swans, one of which has two cygnets and the other, I think, three. There is also another pair, presumably uncygneted, who fly, at intervals, up and down the lake, from end to end, coming, I believe, from another beyond it, and returning into this again. These flights are magnificent to witness (for a Swan is as graceful, or at least, as lovely, in the air as on the water), and they give rise to some strikingly beautiful scenes. The two pairs of Swans belonging to the lake are always, with their respective families, widely separated, whether on the banks or the water—probably they share the ownership of both—and, as the childless pair pass first the one and then the other of them, both the parent birds send up loud, clear, ringing, musical cries, probably (judging by what I have seen and recorded in earlier entries) of protest and defiance.

"Yet it seems like a welcoming."

There was one example of this in the morning, and there has, just now, in the early afternoon, been another. In this last, the first pair of cygneted Swans, as the strangers sailed by, on rhythmically beating wings, confined themselves to melodious outpourings only, but one of the other pair, not satisfied with this, flew out from the bank against them, almost, indeed, engaging with one of them and turning them both from their planned course. Having acted thus worthily, it returned to its family, and a scene of rejoicing then took place between the two parents which passes description. The cries came ringing over the water, and the glasses showed the two lovely birds in a state of triumphant joyousness, their wings, like four broad silver banners, gloriously waving, and their proud necks upstretched. The cygnets, too, I thought, were excited, but they were too much concealed behind the bodies of their parents for me to see if they shared in their actions. When the stranger pair flew by again—for they were not to be permanently deflected—the same bird (presumably) pursued them on their course, but its return was not made the occasion of similar rejoicings. There were a few cries, indeed, but they were much less powerful, and soon subsided, nor did the two parents come close up to one another, as before. Fresh energy, I suppose, required to be stored.

These beautiful wild Swans seem to have both the conjugal and parental feelings strongly developed. They resent any approach (construing the term most widely) of any other Swan to their cygnets, fearing, as I believe, their appropriation. In this they may be well advised, for the Mute Swan, where the conditions admit of it, will incorporate any number of cygnets with its own brood, and the latter seem as ready to follow a foster as a natural parent. Thus in the Swannery at Abbotsbury families cannot long be kept separate, and many Swans are to be seen "with a tail on,"* of a dozen or twenty cygnets or more. It was the keeper's opinion, as expressed to me, that the more any bird could get, in excess of its own, the prouder and better pleased it was, and this was certainly borne out by the look and bearing of all those I saw that were leading these long strings of cygnets. It is indeed asserted—I suppose with truth—that the Mute or Polish Swan may have from six to twelve cygnets, but this I think must be uncommon. At any rate, I did not see a brood of more than six, even if there were any of that number—before they had taken to the water, that is to say before there was an element of doubt. But, at any rate, a following of fifteen or twenty—and many such were to be seen—is beyond the limits of the largest allotted quiverful.

Ravens are common in Iceland. There is a great glamour about this bird, which goes so far with some as to make them want to depose the Eagle in its favour; but then they must be mad or never have seen an Eagle flying, but that is what a glamour can do. As for me, I think I prize the bird at his true worth, but I have not been particularly lucky in regard to him—he has not yet given me of his best. He has never torn up the ground, for me, in impotent fury, or struck a Peregrine dead, in a happier outburst, or done anything preternaturally cunning or beyond the intelligence of another bird, of a Duck or a Curlew, for instance, though I admit he always looked as if it were—much—whatever it was. On the other hand, I have several times seen him cut a somewhat poor figure, and by as much as he was superior in himself, whilst he did so, by so much he cut it more poorly. This morning, for instance, he has flown from lake to mountain pursued by Terns and uttering pitiful cries as

* See 'Waverley,' chap. xvi.

they struck at him, and, on his return, he was served in the same way by Whimbrels, though these, I think, were less unpleasant assailants, and his cries were not quite so plaintive. Again, in the Shetlands, I have seen him thus pestered by Skuas—the smaller kind—and only too glad to get away from them. Three Ravens, if I remember, flying together, were a good deal put upon in this way, and yet not a Skua was struck dead. Of course there is not much in this; Gulls, as has been seen, may tempt Eagles with equal impunity, but the two pictures presented are very different. The Eagle does not cry out in distress. It is magnificent to see him float majestically away from the canaille, not hurry with quick, frightened, undignifiedly flapping wings. Either thus in the air, or standing, stately, on some rock, with great bill raised to repel the impertinence, whilst stooped at and worried by Merlins, always and everywhere the Eagle, like King Lear, is "every inch a King." Depose him for the Raven! That would be "fine revolution," indeed, nor would it end there, for on that day—

> ". . . . shall packhorses,
> And hollow, pampered jades of Asia,
> Which cannot go but thirty miles a day,
> Compare with Cæsars and with cannibals,
> And Trojan Greeks."

Leaving my tent about 3 or 3.30 in the afternoon, I went to the little pool at the head of the bay in which the creek, formed by the entrance of the hardly noticeable stream, commences. In the centre of it were two Phalaropes, one larger and much more brightly marked than the other. They approached one another, and when quite near, the smaller of the two went up, with a little flirt, from the water, flew a yard or so away, and went down on it again—and this was repeated before the birds noticed me. Here then were nuptial activities, but nothing in the nature of predominance on the one part and subjection on the other. The sudden start off of the male had nothing to do with fear, and the flight was a mock one made in a "catch me if you can" sort of spirit, coquettish in short, one and the same with such as I have recorded on the part of the Slavonian Grebes. I watched for some little time, having an umbrella,

and gloves on, but no net round my hat. An umbrella very much lessens the plague of mosquitoes. It seems to puzzle them, the greater part do not come under it, and, of those that do, most fly at once to the top, where they stay. I saw nothing else in the nature of nuptial activities, but a Phalarope bathing was a pretty sight. It made a number of severely straight bobs up in the water, coming down again with equal precision, but the bobs were a good deal higher than those which a bird usually makes on such occasions. Also it bobbed in a more rigidly straight manner, and not with its head alone, but with its whole person, as a mallet would have to do, to bob *its* head, so that the bathing of the Phalarope is something of a unique affair. After bathing came preening. The bird got up upon a mossy cinder (for all the stones here look like, and I believe really are, cinders) to do it, and when it had continued for what seemed like a quarter of an hour, I thought of timing it, and it went on for another ten minutes by my watch. I noticed, or thought I noticed, that its feathers looked wetter than what is usual with ordinary aquatic birds, as if they were not so well provided with oil—not like a Duck's back.

Later, I defied the mosquitoes at this pool—which is a very pretty one—for another *mauvais quart d'heure*, hoping to see something more considerable of the loves of the Phalaropes, but the one bird there, when I came, was not joined by any other. This one, however, enforced my previous observation as to the damage done by this species to mosquitoes, for she was occupied solely in devouring them. They were caught on the water, on the bank and in the air, and often the mossy rocks over which they delighted to hover would be mounted for their sweet sakes. Other favourite resorts were little nooks or miniature creeks of the bank, and particularly where it overhung to any considerable extent, and as this was constantly the case, the bird would have been each time invisible except from the bank directly opposite it, where I sat. It entered more than once a veritable cavern that was formed in this way, and where many mosquitoes danced. "What's the good of mosquitoes?" "What were mosquitoes made for?"—a class of question not yet obsolete, amongst ourselves—would seem a sufficiently bizarre one to a Phalarope. These birds should be encouraged wherever mosquitoes are and

are not wanted—by us. I should be glad of a flock of them in my tent to-night. The Red-necked Phalarope is common in Iceland and—as is commonly the case as between the preyed-on and preying on species, if man will let them both alone—so are mosquitoes.

The Redwing is here, in what may be called the bush country, a thick growth of birch trees, that is to say, dwarfed to that size, and modified into that appearance, growing over a series of intermingled pits and hillocks, the latter being in their foundation great heaps of stony cinders. What has caused the corresponding pits, unless they are the miniature craters from which these have been cast forth, I do not know. A pair of these birds have a nest not far from where I have finally pitched my tent, which is completely hidden now amongst the bushes. Not from them, however, and, up till to-day, their tactics in relation to the settlement have been as follows. Whenever I have gone outside the tent, they have dogged my footsteps in a state of excited apprehension, one of them, in particular, making a violent harsh chattering, whilst the other—I presume the male—has, from time to time, varied it with snatches of song which, though it may not be equal to that of our Thrush or Blackbird, I found pleasant enough to listen to. Or he would sit, for some time, quite silent in one of the birch-bushes—often surprisingly near me—with an expression—or appearance—of combined agitation, resolution and vigilant watchfulness, with which I very much sympathised. When, however, I had entered my tent, which commanded the bird's territory, so to speak, and from which I would gladly have seen something of their un-man-marred ways, they became, from that moment, invisible, save for some chance glimpse, perhaps, though the song was still sometimes to be heard. It was something like "be-dee, be-dee, be-dee" uttered quickly in a wild, sweet tone, having, by its generalised resemblance to that of more familiar members of the family, all woodland associations in it.

"The trick of that voice I do well remember,"

I thought, and England came back to me strangely. To-day, however, neither bird has come near me whilst I have been about—save for one hurried glance, I have neither heard nor

seen them, till now, at 9.45 a.m., the male is singing whilst I write this in my tent. This seems a curious change of tactics. That these birds have a brood of young I know, since I have seen both of them with food in their bills—sometimes whilst they scolded.

A female Merganser, with a perfect swarm of young, came into the bay to-day. Once one, and once two, were on her back. It was difficult to count them, as some would always be coming together or crossing one another, but I think twelve was the number, but possibly thirteen, and eleven as a minimum. Their motion over the water, as also their speed, was most surprising, for they often appeared to—and I believe really did—run upon it. The mother just pursued her course, the young following her. They would spread all about over the water, always seeming to be doing something, one could not say what. They never dived, but yet, I think, found something to feed upon. Then, as the mother began to get too far away from them, they would make little scurrying rushes, to catch her up, some from one direction, some from another, all converging to one point, till they were a closely packed crowd again. Independently of any special cause, however, their idea always seemed to be that there was great cause to hurry, after any short interval of not doing so. At one point the mother passed over a strip of sand, dabbled with water but too shallow for her to swim, walking like a duck, and her brood followed and ran upon the land just as they had been doing in the water. I certainly think they ran in the proper sense of the word, there.

June 29th, 1912.—Have just seen (about 8 a.m.) what might be interpreted as the call or summons or command of one of a pair of Phalaropes to the other to come away, but whichever of these it was, and from whichever of the two—male or female—it proceeded, it was not followed or obeyed. Again, one bird was meandering, in its usual way, on the placid surface (it is now a dead calm) of the lake, when another flew up to it and may possibly—but this I cannot say for certain*—have administered a peck or two; at any rate it came down right beside it and pressed upon it. It then flew to a short distance, but, the other

* See, however, *post*, p. 67.

one continuing to swim as before, quickly flew back to it and pressed upon it again. Then again it flew off to just about the same distance, but was no more followed this second time than it was the first. The called or summoned or commanded bird was deaf to call, summons or command, and showed a properly developed will of its own, in the enjoyment of which it was now left. Now if it was the male bird who thus failed to respond to the wishes—sexual or otherwise—of the female, where was the subjection on his part?—and, *a fortiori*, there would be none if it were he and not she who thus endeavoured to initiate a movement, even though unsuccessfully.

Just before this, four Phalaropes flew, one after the other, in aerial single file, the movements, turns, darts, &c., of all being identical and synchronously performed which had an odd, yet pleasing effect. It would, of course, be natural to suppose that the movements of the first bird were aped by the second, of the second by the third and of the third by the fourth, but surely, in that case, there should have been a perceptible interval of time between those of the first and fourth, if not of the first and second, &c., whereas they all seemed to me to take place at one and the same instant. All three, it may be said, however (but not, I think, truly), might have seen and followed the movements of the first. On either view we have to assume that three of the four birds wished or felt impelled to cut out exactly the same pattern in the air that a bird preceding them did, which, in itself, would be curious. Few probably will suppose that this was a case of aerial drill, and that cries of command (to me inaudible) equivalent to "Right-turn," "Left-turn," "Wheel," "Half-wheel," &c., were uttered, or such ideas in some other way signified, a theory, however, which, to my mind, is still more untenable when we seek to explain identical movements at one and the same instant of time, throughout a great crowd of flying birds—Starlings, for instance. Various considerations (such evidence as I have been able to gather in the course of much psychical reading being one of these) incline me to think it possible that beings may float, as it were, together in a sort of subliminal sea, by the waves and tides of which they may both, at any time, be swayed, and also, at any time act independently of. This may, of course, not be quite right, but

it is better, in my opinion, to hazard a false hypothesis than to ignore a fact.*

Seven Phalaropes are now (10 a.m.) together on the water. One, all at once, makes a little sort of aerial jump out of it, coming down again some two or three yards away. Another flies to this one and then presses upon it, a little, as in the case I have just recorded. It does this several times, at varying intervals, but nothing comes of it. Each time, the bird so pressed upon swims a little away, until the general state of things reasserts itself, the particular episode dying out of them. Clearly then no particular subjection of the one sex to the other is apparent here. Then one bird amongst the little covey flies to another, that one jerks itself away, a third flies up, a fourth follows, and there is thus an ordinary little group of one or two of the one sex pressing amorously on one or two of the other, though here the ordinary rule may be reversed. This continues, the little followings end in little scurryings over the water, but not in what can be termed a flight, and this state of things re-enacts itself, once or twice, the birds spreading out between-whiles, and feeding over the water, as before. The two individuals first mentioned show a more distinct predilection. One presses more assiduously on the other, and follows it thus, in little jerks, then both turn, and the one that has been pressed upon presses in its turn, but not so pressingly, and this, or something of the kind, goes on for some little while, one bird always pressing more than the other, but nothing coming of it till they both get to the shallow shore, where much the same thing, with much the same outcome, continues. All this may suggest an approaching ripeness towards coition, but I see in it no hint of the subjection of one sex to the other, whichever be the one or the other, for the distance is too great for me to

* The problem involved in the fact is still more ignored, the reason, I think, being that whilst most scientific naturalists are "orthodox" scientists, very few psychical researchers are also naturalists. Wallace was, of course, a great exception, but he kept the two severely apart, nor do I judge him to have been a great watcher of animals, but, rather, a gifted handler. For two striking examples of the fact, or class of fact, itself, I would refer the reader to 'Three Summers among the Birds of Russian Lapland,' by Henry J. Pearson (1904), pp. 32–33, and to my own article, there referred to, in the 'Saturday Review' of August 1st, 1903.

distinguish between them. It is the ordinary sexual interplay, even though the order of it be reversed. In the light of the above observations I see no reason to read a peck into the actions of that bird which, a little while before, pressed upon another in a very similar manner.* Is it, however, certain that these activities are of an amorous nature? May they not be bellicose and represent either an approaching or, at least, at any moment, possible combat between two males or two females, or else those peculiar formal movements into which, in many cases, warfare with birds is apt to degenerate? As to this I can only say that the general character of the movements was more suggestive of amativeness than of combativeness. It is somewhat curious, however, if the birds, when thus pressing on one another, were actuated by sexual desire, that that curious whirligig motion which is generally understood to be the courting display, *par excellence*, was not to be seen amongst them. Why, in that case, was it not called into play? Perhaps we have here an antic which is only beginning to come into fashion, and is as yet confined to a minority of individuals. This may be possible, but it cannot certainly be said that the antic itself is only in course of development, for nothing could have been more pronounced and finished than what I saw, albeit that it struck me as pathological. Say, however, that this is a false view, yet it was altogether wanting in certain characters so strongly impressed upon the true actions of sexual display, in birds, that, once seen, it must ever afterwards be either instantly recognised, or, as instantly, missed.

June 30*th*.—To-day, having marked down the nest of a Whimbrel, I watched the bird on to it. This was in the morning. Coming again to my post of observation at about four in the afternoon, the bird, as I approached it (though I was by no means near) flew off the nest in quite an ordinary way, and, alighting at some hundred yards or so away from it, uttered, from time to time, its plaintive "wit-ty, wit-ty, wit-ty, wit-ty, wit-ty, wit-ty, wit-ty, wit-ty," for it ended now with "wit-ty," as throughout, not on the first syllable "wit." In quite a short time—less than ten minutes I should say—he (I afterwards concluded that this was the male) began to walk back to the nest.

* See p. 64.

When at a certain distance from it, he flew past it, in a circling manner, giving it a wide berth, and alighted at some distance beyond it, and from here walked on to it. He did not come up to the nest in a stealthy manner, and did not crouch, and, in sitting, held his head well up, though his whole attitude on the nest was not nearly so upright as that of the Golden Plover that I watched; neither was there the same immobility, the head being freely moved. During all the time that the male sat, the female Whimbrel stood about, at some two hundred yards or so from the nest, and uttered, occasionally, the same plaintive note, but, on the whole, was silent. Upon someone passing, though not at all near, the male again flew up from the nest, and his manner of returning to it, and deportment during the interval, as well as the length of this, were just as before. The female still kept approximately in the same place, and again, once or twice, uttered her plaintive cry, but, for the most part, sat silent and invisible, in the grass. Some cows now began to browse down in the direction of the nest, and one of them coming straight towards it, the sitting bird again flew up, this time closer to the ground than before, and without going so far. The cow came up, smelt at the top piece of turf that had been placed, as a mark, behind the nest, and passed on, on the further side. The disturbed bird did not wait so long, this time, and, in returning, walked straight to the nest, and sat on it with its head turned, now, the opposite way. The female had, some time before this, flown some way to the other side of the nest—coming down no further away from it, however, than she had been before—and I have, since, neither seen nor heard her. It is now nearly 6 p.m., and the male Whimbrel still sits on the nest. After this, the female gave some low subdued "wit-tees" and, towards 7.30 p.m., became, for some time, quite vocal, walking about, at the same time, and I thought she would now go to the nest, and that I should see the change upon it, but in this I was disappointed. Instead of going towards the nest she came towards me and sat on some cut turves almost under me. I, being on the turfed-up eaves of a small cow-shed, had a splendid view of her, standing thus and crying, but it was not what I wanted.

(To be continued.)

THE PHARYNGEAL TEETH OF FISHES.

By Colonel C. E. Shepherd (Indian Army).

(Continued from vol. xix, p. 457.)

Cymatogaster aggregatus. This fish came from Puget Sound, Washington State, U.S.A. It has twenty moderately long horny gill-rakers with soft bristles on them, and four rudimentary ones on the cerato-hypo portion of the first branchial arch. The longest one, at the angle, is about two-thirds of the depth of the gill-laminæ below it. There are six gill-rakers on the first epibranchial. The filter formed by the gill-rakers on the other arches is a very good one, and made in a similar manner to that described for the three preceding fishes. The upper pharyngeals show as one compact group of granular teeth going right across the top of the gullet. The lower pharyngeal bones are united and support a triangular group of similar teeth.

Pleuronectidæ.

This family consists of the so-called "Flat-fishes."

Psetta maxima (the Turbot) has triangular-shaped, stout, fairly long, horny gill-rakers which carry cardiform teeth. There are eleven of them from the angle forward on the first branchial arch, the first four being nearly of a size and about half the depth of the gill-laminæ underneath them. On the first epibranchial there are five slimmer gill-rakers decreasing in size, the upper ones very small; they carry teeth. The inner side of the first arch has only rudimentary traces of tubercles. On the outside of the second arch the gill-rakers are longish tubercles, and on the other arches the gill-rakers are round-shaped tubercles. All these tubercles are set with teeth. The upper pharyngeal teeth are in three groups of cardiform teeth. The upper group is elongate in form, on the head of the second epibranchial; the teeth are small but very closely set. The other groups are on the heads of the third and fourth epibranchial. The lower

pharyngeal teeth are on two long, narrow plates set as a narrow, but irregular V, the right side limb being about twice as broad as the left side; the teeth are cardiform with a stouter row on each inner margin. The gullet was full of food which had evidently been masticated and torn up; it was matted on the gill-rakers, especially in the back part of the gullet on the left side. The food of the Turbot consists of other fish, crustaceans, and mollusks.

Hippoglossus vulgaris (the Halibut) has seven thick, long, upstanding gill-rakers on the first branchial arch on the cerato-hypo portion which bear prominent cardiform teeth at their upper half. The longest gill-raker is a trifle more in length than the depth of the gill-laminæ below it. There are shorter but similar teeth on the gill-rakers of the second arch. On the third and fourth arches the gill-rakers are tubercles which also bear teeth. There are no gill-rakers on the epibranchials. The upper pharyngeal teeth consist of a small group on the limb of the second epibranchial, just under the head, of six teeth in a single row, and on the head itself a line of seven teeth, on the head of the third epibranchial a group of eight teeth, six in a lower row and two above, and one group of eight teeth on the head of the fourth epibranchial; these are all strong cardiform teeth. The lower pharyngeal teeth are two rows of single cardiform teeth converging to form a V of elongated shape; there are a few smaller cardiform teeth at the apex of the V on the outer side. The gill-rakers stand apart and the filter formed is not a good one; there are no gill-rakers on the inner sides of any of the arches.

Hippoglossoides limandoides (the Long Rough Dab). On the first branchial arch in its cerato-hypo portion has eight horny gill-rakers standing rather far apart from each other; they are not toothed. The second and third arches also carry horny gill-rakers on their outer sides; the insides are smooth. The fourth arch has small tubercle gill-rakers both sides. The upper pharyngeal teeth are strong cardiform ones. The lower pharyngeal teeth are in a row on the edges of the lower pharyngeal bones and not carried over any kind of surface (fig. II. 1).

Solea vulgaris (the Sole) has no gill-rakers; there are a few minute papillæ, some six on the first cerato-hypobranchial, with two rather larger ones on the first epibranchial. There were four papillæ on the second arch, and five on the third arch

on the cerato-hypo portion larger than those on the first arch. No filter was possible, unless formed by the arches closing together. The upper pharyngeal teeth are in three groups, one on the head of the second epibranchial, a larger one on the head of the third epibranchial, and one about the same size as that on the second epibranchial on the head of the fourth epibranchial. Each group consists of strong cardiform teeth. The lower pharyngeal teeth are on two long plates, forming a converging V

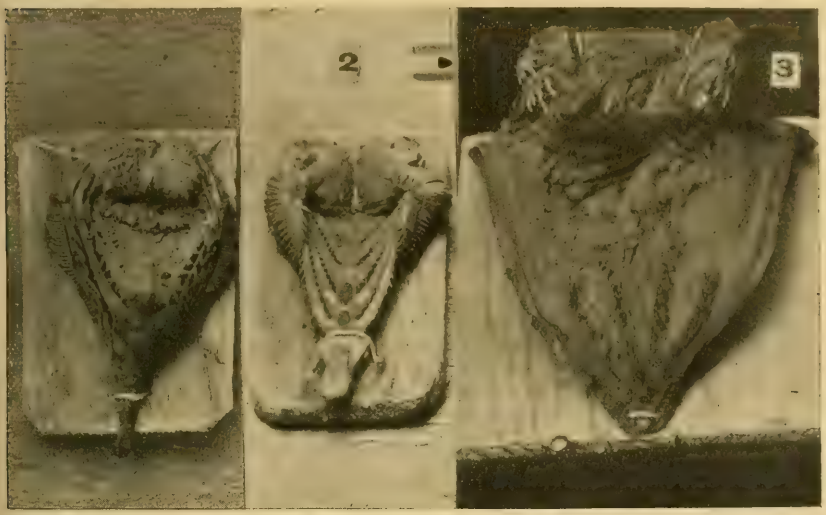

FIG. II.

HIPPOGLOSSOIDES LIMANDOIDES. ECHENEIS NAUCRATES. LOPHIUS BUDEGASA.

in the mouth, that have cardiform teeth, but rather smaller than those of the upper pharyngeals.

KURTIDÆ.

Kurtus indicus, from the Indian Ocean, has eighteen long, horny gill-rakers on the first branchial arch, six of them being on the epibranchial portion. The longest is about twice the depth of the gill-laminæ below it. They are toothed, and speckled with little black dots along their length. The second arch has shorter horny gill-rakers. The third and fourth arches tubercles. This, although a small fish, is well supplied with pharyngeal teeth;

groups of comparatively large size are seen on the heads of the second epibranchial as well as on those of the third and fourth. The lower pharyngeal teeth show in a elongated narrow V-shape.

Echeneididæ.

Echeneis naucrates belongs to the family known as "Sucking-fishes" or "Suckers"; they have a curious elongated disc on the top of the head that enables them to attach themselves to ships, other fish, and turtles; and so they get carried along, being themselves but feeble swimmers. The specimen examined had sixteen horny gill-rakers on the cerato-hypo portion of the first branchial arch, the last five being rudimentary. The other gill-rakers are tubercular. The upper pharyngeal teeth are in two groups on each side of villiform teeth; the groups are large for the size of the fish. The lower pharyngeal teeth are in two triangular groups that meet closely in the middle line. There is a small oval patch of teeth on the basibranchials opposite the junctions of the first and second hypobranchials, and another patch at the junctions of the second and third hypobranchials (fig. II. 2.)

Nototheniidæ.

Trematomus hansoni has fourteen soft gill-rakers on the outside of the first cerato-hypobranchial with nine on the epibranchial. The inside of the first, both sides of the second and third, and the outside of the fourth have shorter soft gill-rakers fitting well into each other and forming a close filter. The upper pharyngeal teeth show in three groups, the upper two crescentic, the lower approximately circular in shape. The teeth in these are so embedded in mucous membrane as not to show, but can be felt by pressing a finger-tip on them; they are cardiform. The lower pharyngeal teeth are in a broad V, similarly embedded. The stomach of the specimen examined was full of the remains of some shrimp-like crustacean in comparatively large lumps; mastication had been but poorly performed.

Batrachidæ.

Batrachus surinamensis, the Pacuma of British Guiana, has ten small flat tubercles for gill-rakers on the first cerato-hypo-

branchial arch, and they carry teeth ; four are placed on top of the outer margin and the other six, likewise on top, but inclined towards the inner margin. The other arches are provided with similar gill-rakers. As for providing a filter to the water passing into the gills, they seem inadequate for the purpose. The upper pharyngeal teeth consist of a long, narrow strip on the second epibranchial; a small group on the heads of the third and fourth epibranchials with two rows of stout cardiform teeth, and a thin narrow line of smaller cardiform teeth on the limb of the third epibranchial. The lower pharyngeal teeth are arranged in two groups forming a crescent well advanced from the œsophagus and having a broad division between them in the middle.

Zoarcidæ.

Zoarces viviparus (the Viviparous Blenny), in the specimen examined, had nine small gill-rakers on the right side, and eleven on the left side on the cerato-hypo portion of the first branchial arch, those in the central position being upstanding; they become more diminutive as they get further forward. The other branchial arches carry gill-rakers that fit in alternately and make an efficient filter. The upper pharyngeal teeth consist in their upper portion of a row of small but strong conical teeth set close together, then a dividing strip of mucous membrane and more conical teeth, but not as long as the upper ones. The lower pharyngeal teeth consist of two groups of conical teeth meeting in the central line of the mouth, but with a well-defined line of separation, the teeth in each group set in two rows, the inner rows being the stronger.

(To be continued.)

NOTES AND QUERIES.

MAMMALIA.

Barbastelle Bat (Barbastella barbastellus) in Wiltshire.—Through the good offices of Mr. H. W. Robinson, of Caton, Lancaster, I received, on October 21st, 1915, seven examples of the Barbastelle bat. These bats had, by the direction of Mr. Robinson, been taken by Mr. G. Gunning, Easton Farm, Sherston, Malmesbury, Wilts, and reached me alive. I was much struck by the very peculiar "hissing" noise made by the bats when disturbed, and this fact has already been recorded by Mr. Charles Oldham in 'The Zoologist' for 1908, pp. 391–2.

These seven examples proved to be five females and two males, all of which appeared to me to be adults.

This record constitutes, so far as I am able to gather, the second record for the occurrence of the Barbastelle in Wiltshire, the only previous record being a single example obtained at Salisbury in 1869 and recorded by Mr. Blackmore in 'The Zoologist' for that year, p. 1558 (Barrett-Hamilton, 'History of British Mammals,' p. 213).

I am pretty sure Mr. Robinson, whilst staying down at Malmesbury, killed another specimen of the Barbastelle; but, unfortunately, the example was sent to a taxidermist, and it arrived in too far gone a state to be preserved.

It is interesting to note that a lapse of forty-six years has expired since the last specimen of the Barbastelle was recorded from Wiltshire, and surely this shows how very scanty is the knowledge of Bat-distribution in Great Britain. Our knowledge of Bats here in North Lancashire, Westmorland, and Cumberland is very limited indeed, and I would only be too pleased if fellow naturalists would turn their attention to the bats in their respective neighbourhoods and forward me any they may capture.—F. W. Smalley, F.Z.S., M.B.O.U. (Challan Hall, Silverdale, Nr. Carnforth, Lancs.).

AVES.

Bird Notes from South Wales.—*January* 23rd: Fourteen White-fronted Geese in Thaw valley. 27th: About 70 wild geese (species undetermined) in same district. 29th: Flock of over 100 wild geese flew over Cardiff. *February* 27th: When out snipe-shooting I found

plenty of "fall" birds, but every Jack appeared to have left the moors. *March* 19th: Several Goldfinches and Lesser Redpolls feeding together in Sophia Gardens, Cardiff. 27th: Sandmartins, a Chiffchaff and a Barn-Owl in Thaw valley. *April* 3rd: Willow-Wren in Thaw valley. 5th: 5 Buzzards near Rhyader; flocks of 10 Curlew and 30 Golden Plover in same district. 6th: Swallows and Sandpipers at Abergavenny. 14th: Cuckoo near Lisvane. 23rd: Swift and Redstart at Abergavenny. 26th: Hawfinch in Sophia Gardens, Cardiff. 28th: Tree-Pipits in Rhymney valley. *May* 1st: Landrail and Yellow Wagtail in Thaw valley. 5th: Whinchat at Marshfield; House-Martins at Abergavenny. 7th: Blackcaps and Whitethroats near Taffs Well. 9th: Spotted Flycatcher at Llandaff; Whimbrel flying over Cardiff. 11th: Lesser Whitethroat at Usk. 15th: 15 Whimbrels flying over Thaw valley; 2 Herons' nests (4 eggs; 4 young); 3 Moorhens' nests (7, 6, and 3 eggs); Jay's nest (2 eggs). 22nd: Reed-Warbler in Thaw valley. 28th: Red-backed Shrike near Pontrilas; Mayfly up well on Monnow. *June* 1st: Turtle-Dove at Cardiff. *July* 3rd: 4 species of Wagtails (White, Pied, Grey, and Yellow) at Llangorse; Nightjar over lake. 4th: In evening saw on lake 12 Great Crested Grebe, 5 Tufted Pochard and family of 10 strong flappers; enormous flocks of Starlings, Swallows, and Pied Wagtails roosting on reeds. 5th: Buzzard near Talgarth; Curlew's nest near Bronllys. 6th: 6 Common Terns visited Llangorse Lake. 8th: Saw 7 young Wheatears, Red Grouse, and my last Cuckoo on Llangorse Mountain. *August* 2nd: 2 Teal on Llangorse Lake; I do not think they ever breed here. 4th: Whilst I was waiting on the lake for the evening duck flight sport was badly handicapped by an enormous flock of Sand-Martins, which seemed determined to roost on one particular bed of reeds; many actually settled on the boat, and others hovered over the gun-barrels. 8th: Nuthatch at Llangorse; I saw altogether 71 species of birds in this district. 13th: Raven on Black Mountains. 17th: Plenty of Swifts about; all left on the following day. *September* 12th: Wheatears and Spotted Flycatchers still in Thaw valley. 13th: Shot a Red-legged Partridge, and saw Corn-Bunting, Barn and Tawny Owl near Hereford. 25th: Shot last Landrail of year. *October* 6th: Owl hooted several times about 2 p.m. near Brecon. 11th: Saw over 100 Swallows and a late Whinchat near Pontrilas. 17th: Jack-Snipe re-appeared; shot 4 in one field. *November* 6th: 3 Swallows in Thaw valley; first Woodcock of season in; shot a brace. 20th: Great Spotted Woodpecker near Llantrithyd. 23rd: 12 Bullfinches near Pentyrch.—SIDNEY W. WHITE (Cardiff).

Bird Notes from the Bavarian Tyrol in 1910–11.—Whilst travelling out to, and during my stay in, the Bavarian Tyrol on the way to Ober-Ammergau for the Passion Play, I was able to make the following observations. On June 28th, 1910, on the journey through Holland, I noted the following birds: many Common Gulls and some Black-headed Gulls near the Hook of Holland; further inland Herons, Grey Wagtails, Common Sandpipers. Close to Würzburg I saw a pair of Hoopoes near the river. On June 30th, at Partenkirchen, Bavaria, I saw Cole and Marsh Tits, Common and Black Redstarts, and some Grey Wagtails. On July 1st I found a Robin's nest with five eggs; Common Redstarts were numerous, and I saw a few Black Redstarts. I also saw on that day a Lesser Whitethroat and some Carrion Crows. On going over to Ober-Ammergau, some nine or ten miles distant, I saw a pair of Black Redstarts feeding their young in a nest somewhere high up on the inside of a roof of the out-of-door theatre during the performance of the Passion Play; the cries of the young were most noticeable. Whinchats were numerous in the river valley between Partenkirchen and Ober-Ammergau, and, in fact, during all our stay in these parts they were the most numerous of all species, and were constantly seen feeding their fully-fledged young. On July 6th I saw several Black Redstarts, and on the 7th one Buzzard and two Ravens near Elman; also a hen Black Redstart feeding the young in a hole in the low roof of one of the picturesque wooden houses. On the way back we noted two more Buzzards, one flying very low, so that we were able to get a very good view of the rounded effect of the end of the wing. We also saw one male Red-backed Shrike. We found another nest of young Common Redstarts on July 8th. On July 10th we had one of the most interesting days from an ornithologist's point of view, for we met with two birds which are unfamiliar to anyone living in these islands—namely, the Great Black Woodpecker and also the Alpine Chough. It was on the way up to the Kreuzeck that we saw the Black Woodpecker, and at the same time we saw his more familiar relative, the Great Spotted Woodpecker. On reaching the hut at the Kreuzeck I was startled by a curious chattering sort of call proceeding from the cliff near by, and on hurrying in that direction I was delighted at seeing a pair of Alpine Choughs fly out quite near to me, so that I was able to note their bright yellow bills. Three more Buzzards were seen this day, and also some Goldcrests. Travelling home from Bavaria by way of Innsbrück and the Vor Arlberg Railway, and the Lake of Constance, little was noted except a few Black-headed Gulls. A pair of Storks were seen on their nest

on the roof of a cottage soon after passing the Black Forest. The weather was extremely bad that summer, being wet nearly every day, which probably accounted for our not seeing more birds. In 1911 I again visited the same part of the Bavarian Tyrol, and this time the weather was extraordinarily hot and fine, and, with the exception of a few thunderstorms, we had no rain. We were also a little later in the year, and our list of birds was considerably lengthened. We saw again many Whinchats; Redstarts, both Common and Black; and numbers of Swallows. On August 18th I went up the Höllenthalklamm, where I saw three Wall-creepers on a rock, and was able to note the beautiful grey plumage with the crimson patch on the wing. I also saw White Wagtails on the mill-stream at Partenkirchen and elsewhere. This beautiful bird takes the place of our Pied Wagtail in these parts, and seemed just as plentiful. On the 19th I saw a specimen of the Little Owl (*Athene noctua*), stuffed, in a shop in Parmisch. On asking the owner, he told me that it had been shot in the woods near. On my way out I had seen this bird perched on a telegraph pole close to the Hook of Holland. On the 21st I went up the Fauken, where there was a pair of Grey Wagtails, and I also came across, for the first time, the Crested Tit, which is said to be numerous in the woods near there. Next day I saw a pair of Dippers on a very rapid mountain stream, three Buzzards, and a Raven. On the 25th I saw the first Nutcracker, a bird which is fairly common in this part of Bavaria. I again and nearly every day saw White Wagtails, Goldcrests, and Marsh Tits. On the 28th we went up a low mountain called the Krottenkopf, where we got a sight of nineteen Chamois feeding; this was at 5.30 a.m. Later in the day we saw two Golden Eagles. On the 31st we saw two Kestrels, three Buzzards, Grey Wagtails, Nutcrackers, and a Little Grebe on a small lake near Eckbauer. On September 1st, on going up to the Kreuzeck, close to the same place as last year, I again saw the Great Black Woodpecker, as well as Buzzards, Jays, several Nutcrackers, and Crested Tits. We climbed the Zugspitz on September 2nd and 3rd. This is the highest mountain of Bavaria, close on 10,000 feet, and I was much interested in seeing about twelve Alpine Choughs on the summit; they seemed fairly tame, and we were able to approach quite close to them. Amongst many Swallows' nests which we found, the following was very interesting. A small shelf was put up in the main passage of a farm house leading from the front door, and on this shelf a pair of Swallows had made their nest and were rearing a family of young, even though only a few inches above the heads of everyone passing, as the passage

was very low. Returning to England *viâ* Innsbrück and the Lake of Constance, I had a fine sight of an Osprey fishing on the lake. There were also many Gulls, Terns, and flocks of Duck, though I was never able to get near enough to identify the latter.—(Miss) Clemence M. Acland.

Female Carolina Duck in Male Plumage.—There is at present on the Three-Island Pond at the Zoo a female Carolina Duck (*Aex sponsa*) which has assumed the plumage of the male to a remarkably complete extent. The general effect is duller, especially as regards the gloss on the head, and the markings less clearly defined, but on the whole the difference from the male is not greater than that seen in the female common Sheldrake (*Tadorna vulpanser*). The glossy parts, however, are more bronzy than in the drake, and the wing-coverts show the black tippings only found in the female. The bill, eyelids, and eyes are feminine in colour, and the legs, though more orange than in a normal female, are not so bright as a male's. A little time back another Carolina duck at the Zoo assumed male plumage, but less completely than the present bird; she never looked well, and is now dead, whereas the present bird seems healthy and vigorous. In this second specimen the eyes and bill were also feminine.—F. Finn.

REPTILIA.

Hardiness in a Chameleon.—On the afternoon of November 13th a fine large specimen of the Common Chameleon (*Chamelæon vulgaris*), ten and a half inches in length, and apparently in good health, was brought to me by a gentleman who had found it on a plum tree in a garden at East Dulwich. It is somewhat difficult to keep a chameleon in the cold weather, and it seems noteworthy that this individual should have been in an almost normal state of activity after being even a short time in the (at that time very cold) open air in November, though we have no means of knowing how long the animal had been at large. About three weeks after it was brought to me the animal passed a whitish-yellow fæcal mass, and also a large dark mass, $1\frac{2}{12}$ in. in length and $\frac{5}{12}$ in. in thickness. The latter mass was found on examination to be wholly composed of the remains of blow-flies, amongst which I counted 21 heads. The Chameleon is being kept in a room which has a temperature of about 50–55° F., and is still (January 23rd) alive and active, though it has not yet taken any of the Stick-Insects which have been offered to it as food. When captured the animal was of a dark

brownish colour, but on being brought to the fire it turned to a bright yellowish-green with several light lilac patches on each side. It may also be remarked that the side of the animal near the fire turned of a light colour more rapidly than did the other side. The general colour of the animal since its capture has varied from dark green to light yellowish-green, and at no time have I seen it resume the dark brown colour.—H. N. MILLIGAN.

CRUSTACEA.

Hermit-Crabs Changing Shell in Face of Danger.—In September of 1915 I put several examples of the Common Hermit-Crab (*Eupagurus bernhardus*) into an aquarium which already contained two average-sized and pugnacious Shore-Crabs. Five Hermit-Crabs, whose stained and battered shells were easily to be distinguished from the clean whelk shells which were present in the aquarium for the use of the newcomers, had been dropped into the tank, when the Shore-Crabs proceeded to attack the Hermit-Crabs and to try to pull them from their shells, in which efforts, however, they were not successful. I had turned away, for only about a minute or a minute and a half, in order to examine further into the contents of the collecting-can in which the Hermit-Crabs had travelled, when my attention was called by an attendant to the behaviour of the Hermit-Crabs in the tank. Two of them had quickly changed into new shells, and I was in time to see them retreating across the floor of the tank in front of a demonstrative Shore-Crab. Perhaps the Hermit-Crabs had been ready to change shells at the time they were captured at the seaside; they had been so much alarmed by the attacks of the Shore-Crabs in the tank that they had preferred to take the momentary danger of the change from shell to shell to withstanding the attacks of their enemies. The difference in size between the old and the new shells was by no means marked, and this raises some perplexing questions, *e.g.*, *By what means were the Hermit-Crabs able to decide so rapidly that the new shells were to be preferred to the old ones?* Hermit-Crabs are so commonly kept in aquaria that observations should be fairly plentiful, and it would be of interest to know what facts similar to those mentioned above have been recorded in the note-books of those who keep marine aquaria.—H. N. MILLIGAN.

ASTEROIDEA.

Cushion-Stars Attacking Brittlestars.—On the afternoon of March 3rd, 1915, I obtained three individuals of the Common

Brittlestar (*Ophiothrix fragilis*), each of which was about four inches in diameter, in a dredge on the coast of Essex. During the journey to London in the collecting-can the Brittlestars amputated their arms close to their discs. The mutilated Brittlestars were, however, placed in an aquarium, as I had often been able to keep such injured specimens during the regeneration of their arms. In the same aquarium there were several examples of the Cushion-Star (*Asterina gibbosa*), of about one and a quarter inches in diameter. On the following morning (4th) I found that a Cushion-Star had enveloped one of the Brittlestars in its arms, and on the 5th there was nothing to be seen of the ophiuroid except fragments of skeleton. The remaining two Brittlestars were destroyed by the Cushion-Stars during the next two or three days.—H. N. Milligan.

ANTHOZOA.

Opelet Sea-Anemone Temporarily Attached to Shore-Crab.—On November 13th I found that a Shore-Crab (*Carcinus mænas*) which was confined in an aquarium with a number of examples of the Opelet Sea-Anemone (*Anthea cereus*) had one of the Sea-Anemones attached to its abdomen. The Sea-Anemone measured about two inches across its extended tentacles, and the Shore-Crab about six inches across its extended legs. The Sea-Anemone was attached by its base to the lower and hinder part of the abdomen in such a way that its disc and tentacles dragged behind the Shore-Crab when the latter walked on the floor. I do not know when the cœlenterate attached itself, but it must have been at some time between the afternoon of the 12th and 9.15 a.m. on the 13th. It was attached with some firmness to the Shore-Crab, but it became detached from the crustacean during a fight which the latter had with another Shore-Crab at feeding time, about 9.30 a.m. It may reasonably be conjectured that the Shore-Crab had sat for some time over the Sea Anemone whilst the latter was attached to the rock by its tentacles alone, its base being free and directed upwards, as occasionally happens when the Sea-Anemones are moving from one place to another. The Sea-Anemone had then attached itself by its base to the motionless Shore-Crab, just as it would have attached its base to another part of the rock. The Shore-Crab displayed no signs of uneasiness in regard to its burden. This occurrence is interesting, because it may perhaps illustrate one of the stages through which such Sea-Anemones as *Sagartia parasitica* have passed in the course of their evolution into commensal forms.—H. N. Milligan.

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THE ZOOLOGIST

No. 897.—March 15th, 1916.

OBSERVATIONS ON THE FEEDING HABITS OF THE PURPLE-TIPPED SEA-URCHIN.

By H. N. Milligan.

Although the Purple-tipped Sea-Urchin (*Echinus miliaris*) is very abundant around our shores, and is doubtless often kept in aquaria, our knowledge of its feeding habits, as is so often the case with common sea-shore animals, is very meagre. With the exception of Eichelbaum's* investigations into the contents of the intestines of eleven examples of this Sea-Urchin, varying from 17 to 48 mm. in diameter,† from the North Sea, only minor notes on the subject are to be found scattered sparsely through the literature relating to echinoderms. It therefore seemed advisable to record the new observations which are contained in the following paper. These observations are based on the detailed notes which have daily been made by me upon the behaviour of the Purple-tipped Sea-Urchins (some sixty in number) which have lived during the last three years in the marine aquaria at the Horniman Museum. The following are the subjects which will be discussed: (1) Animal matter as

* E. Eichelbaum, "Über Nahrung und Ernährungsorgane von Echinodermen," 'Wissench. Meeresuntersuch. v. d. Kommission z. Wissen. Unters. d. Deutsch. Meere in Kiel,' N. F., Band 11, Kiel, 1910, pp. 189–275.

† Eichelbaum's measurements, and also those given by myself, are those of the long diameters of the tests, excluding the spines.

food; (2) vegetable matter as food; (3) inorganic matter as food; (4) the search for food; (5) the positions and postures adopted in feeding; and (6) the time spent in feeding.

1. Animal Matter as Food.

Chordata.—Eichelbaum found remains of the ascidian *Cynthia* in one, and probably in two, of the eleven Sea-Urchins which he examined.

A Sea-Urchin, 23 mm. in diameter, was observed by me to devour part of an *Ascidia sp.* of 30 mm. in length. The species of fishes which have died in the aquaria and have been wholly or partially devoured by the Sea-Urchins are the Striped Wrasse (*Labrus mixtus*), Common Goby (*Gobius paganellus*), Gattorugine Blenny (*Blennius gattorugine*), and Plaice (*Pleuronectes platessa*). The fins, flesh, and viscera of the fishes have been eaten, but the bones have usually been neglected. A Sea-Urchin, however, which was given a small mass of bone from the skull of a Gattorugine Blenny, the flesh of which had been scraped away by other echinoids, ate a portion of it. In has already been recorded in 'The Zoologist' that four Sea-Urchins were seen to work with their teeth upon two groups of eggs laid by a Sea-Bullhead (*Cottus bubalis*), though with what result it was difficult to see.* Raw beef is eaten with avidity. The Purple-tipped Sea-Urchin would probably eat any dead marine chordate, or even any dying chordate which it could attack with success.

If the Sea-Urchin can once obtain a grasp of a small dying fish, it holds the fish tenaciously, as is exemplified by the following incident.† A Striped Wrasse of 40 mm. in length, which was thought to be dead, was removed from an aquarium in order that it might be used as food for the Sea-Urchins. When, however, the tail of the fish was thrust beneath the body of one of the Sea-Urchins, 38 mm. in diameter, which was clinging to the vertical side of the aquarium, the fish suddenly began to

* H. N. Milligan, "Notes on the Eggs and Larvæ of a Sea-Bullhead (*Cottus bubalis*)," 'Zoologist,' vol. xix, 4th ser., 1915, pp. 292–6.

† I have not been able to find any previous record of this Sea-Urchin deliberately holding prey with its spines, but H. Eisig ("Biologische Studien angestellt in der Zoologischen Station in Neapel," 'Kosmos,' vol. xiii, 1883, p. 128), mentions that an *Echinus* (*Strongylocentrotus*) *lividus* held a worm with the points of its spines.

struggle. The Sea-Urchin held it tightly by pressing a number of spines not only around but also upon the body of the fish, those spines which were pressed on the prey being used with such effect that they made deep indentations in its body. The Sea-Urchin now raised one part of its body from the side of the tank, and with spines and tube-feet gradually urged its prey towards the mouth, the fish, in spite of several efforts, being unable to get free. As soon as the prey had been brought into such a position beneath the mouth that the teeth could conveniently work upon it, the Sea-Urchin attached a number of tube-feet to, and also pressed spines upon, the side of the tank in such a way that the victim was imprisoned as in a cage. The Sea-Urchin remained for several hours upon the Wrasse, of which it ate about a third part, afterwards allowing the remainder to fall to the bottom of the aquarium.

Arthropoda.—Eichelbaum found remains of crustaceans in each of his eleven examples. These remains consisted of legs, antennæ, etc., fragments of small crabs, and also copepods and a questionable *Gammarus.*

One of the Sea-Urchins studied by me climbed on to a living Top (*Trochus zizyphinus*), which bore several living Acorn-Barnacles (*Balanus balanoides*), broke up the shells, and then ate the soft parts of the cirripedes. A large dead Common Hermit-Crab (*Eupagurus bernhardus*), which was placed in an aquarium containing twelve Sea-Urchins, was soon attacked by four of the echinoids; they ate the whole of the Hermit-Crab's abdomen (including the limbs), three of the walking legs (the great claws not being touched), most of the carapace and contents of the thorax, and the antennæ of one side. A large male Long-legged Spider-Crab (*Stenorhynchus phalangium*) died during the night, and before the morning was partly eaten by a large Sea-Urchin, which completely devoured the small abdomen of the crustacean, and scraped away the surface layer of a considerable area of the under surface of the thorax. Two of the great claws of a Common Spider-Crab (*Hyas araneus*) were given to two large Sea-Urchins, and in both cases they were almost wholly eaten. Six walking-legs of the Common Spider-Crab and two of the walking-legs of the Shore-Crab (*Carcinus mænas*) were on one occasion distributed amongst eight large Sea-Urchins, and were

wholly or partially eaten. The long halves of four of the legs of *Hyas*, together with their soft contents, were eaten, and the other halves then abandoned. It may also be remarked that on three other occasions when Sea-Urchins ate halves of limbs, they afterwards placed the uneaten halves on their upper surfaces amongst the other foreign objects with which the Purple-tipped Sea-Urchins so frequently load themselves. A carapace, 48 mm. in length, of a dead Common Spider-Crab was given to a Sea-Urchin of 38 mm., and was nibbled around its edge.

The avidity with which the Purple-tipped Sea-Urchin will feed upon an exoskeleton which has been moulted by a shrimp or prawn is very remarkable; indeed, it has now become my practice to give all such cast exoskeletons to the Sea-Urchins as part of their food, and they are very seldom refused. Out of thirty-three consecutive exoskeletons of shrimps, varying from 45 to 75 mm. in length (excluding the antennæ), all except two were at once taken by the Sea-Urchins to which they were presented, and the two exceptions were afterwards eaten by other Sea-Urchins. It should be understood that the exoskeletons are not eaten only by starving Sea-Urchins; they are eagerly taken by well-fed individuals which immediately before have been devouring seaweed. A Sea-Urchin of 42 mm., abundantly supplied with seaweed, ate each of the fifteen successive exoskeletons which were given to it in the course of thirty-one days.

The worm-shaped fæces of the Shore-Crab, Common Spider-Crab, Common Hermit-Crab, and Sea-Bullhead are eaten by a Sea-Urchin whenever these are offered to it. The echinoids would probably eat the fæces of almost any other marine animal. A Sea-Urchin detected the presence of three fæces (of 15, 21, and 25 mm. in length) of a Shore-Crab when they were placed three-quarters of an inch away; and within a few minutes the animal approached, and ate them.

It has already been mentioned (p. 83) that the tube-feet and spines may be used to imprison a dying Wrasse, and it may here be added that these appendages are of great use in holding food when the Sea-Urchin is clinging to a vertical surface. When, for example, a Sea-Urchin, attached to the glass front of the aquarium, is given the exoskeleton of a shrimp, it may dis-

member the exoskeleton in the course of the meal, but will retain such a hold of the separate parts that few, or in some cases none, of them are allowed to fall to the bottom until the Sea-Urchin has finished. A Sea-Urchin of 32 mm. to which one of the slender antennæ, $5\frac{1}{4}$ inches long, of a Spinous Galathea (*Galathea strigosa*) had been given, at once held the antenna by quickly crossing those spines bordering the antenna as it lay on the upper surface of the echinoid. The antenna was eaten partly by this Sea-Urchin and partly by another one, which rapidly approached from a distance of four inches in order to join in the meal.

Mollusca.—The remains of molluscs were found by Eichelbaum in seven Sea-Urchins. They consisted of fragments of lamellibranchs, and of lamellibranch and pteropod shells (including *Cardium* and *Limacina*).

All the Sea-Urchins studied by me have readily eaten the soft parts of dead and gaping mussels. They have also attacked, killed, and partially or wholly eaten living gastropods in large numbers. For example, about sixty individuals of the gastropod known as *Rissoa membranacea*, with an average length of shell of 5 mm., were placed in the aquarium containing the twelve Sea-Urchins already referred to, on September 16th; about fifty specimens of *Rissoa* were added in October; about fifty others in December; and several others were added on various dates; nearly two hundred in all were placed in the tank in the course of four months. Many of the *Rissoæ* were killed and eaten by several Cushion-Stars (*Asterina gibbosa*) which lived in the same tank, but about an equal number of them were eaten by the Sea-Urchins, and by the end of the following January there were only about a dozen left. A Sea-Urchin has been seen on the glass front of the aquarium holding as many as four living *Rissoæ* at once; one of the molluscs, at the time the observation was made, being actually held to, and partly in, the mouth, whilst the others were imprisoned between the glass and the spines of the Sea-Urchin.

A Sea-Urchin will "sit" persistently upon the inverted shell of a living or dead gastropod until sooner or later it is able to extract the animal. A Sea-Urchin of 21 mm., which was observed to be sitting on an inverted Top (*Trochus zizy-*

phinus), was suddenly lifted in order that it might be ascertained what the echinoderm was doing; and it was then found that the latter was so firmly affixed by spines, tube-feet (and pedicellariæ ?), that the Top, which was dead, was dragged from its shell. The individuals of the Dog-Whelk (*Nassa reticulata*), some sixty in number, and of the Periwinkle (*Littorina littorea*), some fifteen in number, which have from time to time been placed in the tank containing the twelve Sea-Urchins, have been much persecuted by the echinoids. The operculum of one such Periwinkle, which was rescued from a Sea-Urchin, had been nibbled around its edge, no doubt during an attempt of the Sea-Urchin to reach the soft body of the mollusc. In the case of a gastropod, which of course is able to withdraw into its shell for some distance, the extensile mouth-membrane and the protrusible teeth and lip of the Sea-Urchin must be of great use; but it is impossible to observe directly what happens, owing to the close contact between the lower surface of the Sea-Urchin and the mouth of the shell. A Sea-Urchin may be seen from time to time to climb slowly up the glass, dragging with it, and eating, the body (without the shell) of a Periwinkle or a Dog-Whelk.

The Sea-Urchins have also eaten the eggs laid by Dog-Whelks. On two occasions they have been seen to devour the byssal threads abandoned by an Edible Mussel (*Mytilus edulis*).

A Sea-Urchin will sometimes place itself in such a position that it can firmly hold a living mollusc, and will then repeatedly scrape the surface of the shell with its teeth, in some cases apparently in order to eat the hydroids, polyzoans, or seaweeds which grow upon the shell, and in other cases to eat the periostracum. This has been observed in the case of the Edible Mussel, Slipper Limpet (*Crepidula fornicata*), Dog-Whelk, Sting-Winkle (*Murex erinaceus*), and Dog-Winkle; and the rugosities of the shells of the Sting-Winkle and Dog-Whelk may be scraped in this way until they become worn down to the level of the rest of the shell (fig. 1, A). In doing this the Sea-Urchin may desire to reach and eat the shell, as well as to obtain the materials which invest it. Indeed, the Purple-tipped Sea-Urchin will eat comparatively large quantities of shell. The

subject of shell-eating by this animal, which has received little or no attention, is one peculiarly deserving of study. An empty shell, if it is not thick and heavy, which lies in an aquarium containing a number of healthy Sea-Urchins, will probably be bitten sooner or later by the echinoids.

On August 8th an average-sized, old, and friable shell of a

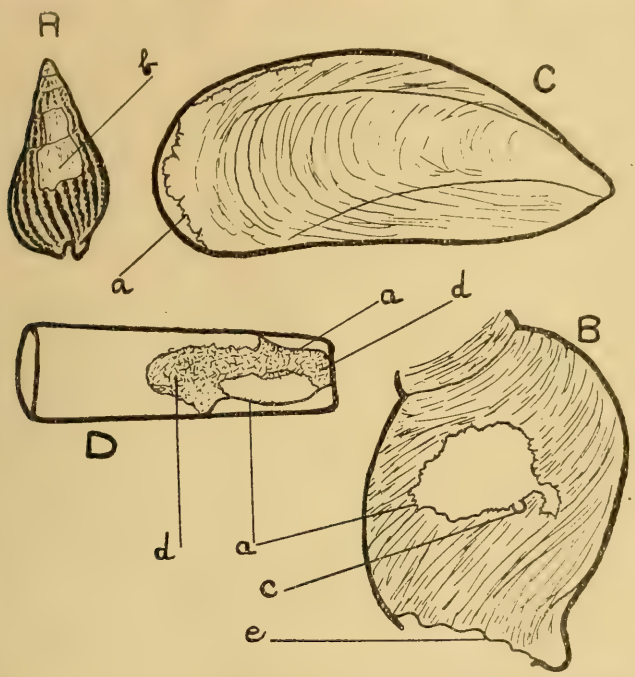

FIG. 1.—Objects eaten by Purple-tipped Sea-Urchins. A, shell of Dog-Whelk; B, last whorl of shell of Whelk; C, right valve of shell of Mussel; D, piece of chalk. In all cases the original size of the object is indicated by the thick black line, and the amount eaten is shown by the thin line, lettered, *a*, *a*, *a*; *b*, area of rugosities scraped away; *c*, boring made by carnivorous mollusc; *d*, impressions of teeth of Sea-Urchin; *e*, broken part of shell not eaten by Sea-Urchins. (All natural size.)

Whelk, to which were attached thirty-five empty shells of the Acorn-Barnacle, was put in the tank containing the twelve Sea-Urchins, whose diameters ranged from 10 to 27 mm. By August 20th eight of the barnacle shells had been gnawed away completely, together with part of the last whorl of the whelk shell (fig. 1, B). The Sea-Urchins apparently began to break away the shell of the Whelk at the place where a circular

hole had been bored by a carnivorous gastropod during the lifetime of the Whelk (fig. 1, B, *c*). About half of a large whelk shell, which was broken up and thrown into the tank on August 2nd, was eaten by the Sea-Urchins by the 9th, certain of the harder parts of the shell, however, such as the columella and shell-siphon, being left uneaten until the present. A Sea-Urchin will seize a living Periwinkle, or an empty periwinkle shell, and hold it in such a way that the thin edge of the lip of the shell lies conveniently under the mouth of the Sea-Urchin, and the latter will then proceed to snap off tiny pieces along the lip. Two or three Periwinkles which had evidently been treated in this fashion were at one time to be seen crawling about the aquarium; but, of course, it is only in the rare case of a mollusc being seized when it is close to the glass that the process can actually be watched.

The shells of several living Edible Mussels have been damaged by the Sea-Urchins, and in all cases they were bitten at their hinder ends (fig. 1, c). On several occasions a Sea-Urchin has gnawed the valves of a Mussel in such a way that a gap has been made between them; and through this gap the thick edge of the retracted mantle, where it forms the boundaries of the inhalent and exhalent apertures, could be seen. In at least two cases a large Common Starfish (*Asterias rubens*), attracted by the exposed soft parts of the Mussel, has attacked and opened the mollusc. This matter may deserve further investigation from the bionomic and economic points of view, as it is known that a Starfish can throw its stomach through a comparatively narrow aperture.*

Echinodermata.—Eichelbaum found the remains of echinoderms in ten examples. These remains were those of asteroids, ophiuroids, and echinoids, and they included shell fragments, spines, and pedicellariæ.

* M. Hesse ("Note sur les Motifs qui determinent les Oursins a se creuser dans les Rochers," 'Ann. d. Sc. Natur., T. vii, series 5, 1867, p. 259) mentions that *Echinus miliaris* will bore into oyster shells. K. Möbius ("Über die Thiere der Schleswig-Holsteinschen Austernbänke," 'Sitzungsb. König. Preuss. Akad. Wissen. Berlin,' vol. viii, 1893, p. 81) says that he is doubtful whether it attacks living Oysters. E. J. Allen ("On the Fauna and Bottom Deposits, etc.," 'Jour. Mar. Biol. Assoc.,' vol. v, (N. S.), 1897–9, p. 474) says that it does great damage on oyster-banks.

It has been said that the Sun-Star (*Solaster papposus*) is poisonous to some animals,* but the following observation suggests that the rays at least do not injure a Purple-tipped Sea-Urchin which eats them. A portion (8 mm. in length) of a ray was removed from a Sun-Star on August 6th, 1915, in the course of certain experiments upon the capacity for ray-regeneration in that asteroid, and the amputated ray was then (10.30 a.m.) immediately given to a little Sea-Urchin of 10 mm. in diameter. The Sea-Urchin began at once to eat the ray, and it was engaged in its meal, at the place where it began it, until 11 a.m. on the 8th, by which time no fragment of the ray could be discovered. The Sea-Urchin appeared to suffer no ill-effects, and is still (February 26th) alive and well.

The Sea-Urchins will devour relatively large quantities of skeletons of echinoderms, just as they will devour shells and exoskeletons of crustaceans. On July 29th the end portions (each about 33 mm. in length) of two rays of a Common Starfish, which had previously been completely skeletonised in potash, were placed on a horizontal rock close to two Sea-Urchins. The latter began to eat the skeletons, and when two other Sea-Urchins were placed close to them they also joined in the meal. Next morning (30th) only a few tiny fragments of the white skeletons were to be seen. On the same day (30th) about one-third of the test of an average-sized Edible Sea-Urchin (*Echinus esculentus*) was broken up and thrown into the aquarium. On August 2nd there were added broken skeletons of an average-sized Sun-Star and of a large Purple-tipped Sea-Urchin, together with the broken whelk shell already mentioned (p. 88). By August 9th none of this material was to be seen, excepting several of the larger pieces of the test of the Edible Sea-Urchin and the harder parts of the whelk shell, which still remain uneaten. It seems probable that the spines which fall from living Sea-Urchins are eaten by other Sea-Urchins—they certainly soon disappear from the aquarium—but a Sea-Urchin has not yet been detected in the act of eating a spine. Eichelbaum, it is interesting to note, found spines of

* C. A. Parker (in a Note in the 'Zoologist' of 1881, vol. xxxix, pp. 214–5) records the death of two cats, one within a quarter of an hour, and the other in about two hours, after eating a Sun-Star.

echinoids (species not mentioned) in three of his eleven examples.

Polyzoa.—The remains of polyzoans, all of which were *Membranipora*, were found by Eichelbaum in six cases. Living colonies of *Membranipora pilosa* have been largely eaten by the Sea-Urchins studied by me. The *Membranipora* may simply be eaten along with seaweed which it encrusts, or it may be scraped away from a hard substance. Several Mussels, whose shells were nearly covered with *Membranipora pilosa*, have been persistently scraped by the Sea-Urchins, and the polyzoans eaten. Fronds of the Sea-Mat (*Flustra foliacea*) also have been devoured.

"*Worms.*"—Worms, including the bodies and tubes of polychætes, tubes of *Pectinaria*, and Spirorbs and Serpulids, were found by Eichelbaum in eight cases. A Sea-Urchin has been seen by me to perch itself on the top of a living Sting-Winkle, and then to eat the empty tubes of *Serpula* which were attached to the shell of the mollusc. Masses of *Sabella penicillus* have been attacked, and portions of the tubes, and sometimes the worms, eaten. *Spirorbis* is eaten in considerable quantity along with the seaweeds to which it is attached.

Cœlenterata, Porifera, and Protozoa.—Eeichelbaum found remains of hydropolyps in eleven cases; these were mainly of *Obelia*, but also of *Campanularia*. Traces of sponges and sponge-spicules he found in five Sea-Urchins, in two instances these being the remains of *Esperia*. Protozoans, mostly rotalids, occurred in eleven cases. The Sea-Urchins observed by me have eaten living and dead masses of *Obelia* and *Hydrallmannia falcata*, and small sponges attached to seaweeds.

2. Vegetable Matter as Food.

The remains of plants, which included diatoms and fragments of algæ, were found by Eichelbaum in each of his eleven Sea-Urchins. Allen mentions a small Sea-Urchin, living in a shallow dish of sea-water for several months, which devoured large quantities of red seaweed.* Petersen, according to Eichelbaum,† mentions remains of plants and diatoms found in the Sea-Urchins.

When the contents of the intestines of Sea-Urchins are

* E. J. Allen, *loc. cit.*, p. 474. † *Loc. cit.*, p. 225.

examined, the recognisable fragments may consist mainly of those of animals, but observation of the habits of captive specimens suggests that by far the greater portion of their food in the sea consists of plants. The quantity of seaweed devoured in the aquarium by Sea-Urchins is very large. The echinoids will remain in the midst of a mass of seaweed for weeks at a time, constantly devouring it, until the seaweed has become reduced to heaps of fæcal pellets. Any kind of seaweed seems to be acceptable to the Purple-tipped Sea-Urchin. Dead or living *Corallina*, and *Zostera marina*, are readily eaten.

3. Inorganic Matter as Food.

The Purple-tipped Sea-Urchin will swallow sand and shell-gravel in the absence of other food. Eichelbaum mentions that he found materials of the sea-bottom (*Bodenmaterial*) in eleven of his Sea-Urchins, and he quotes Petersen has having found fragments of calcareous matter and sand.

It has already been mentioned that such substances as the skeletons of echinoderms (p. 89), shells of molluscs (p. 86), and exoskeletons of crustaceans (p. 84), consisting wholly or largely of inorganic matter, are eaten by the Sea-Urchins. These materials, it should again be observed, are not necessarily taken only by hungry individuals, nor only by certain individuals. This curious habit is being made the subject of further observations, but it may here be added that the Sea-Urchins will devour the ordinary chalk prepared for use with the blackboard. For example, on the afternoon of September 7th, a Sea-Urchin of 19 mm. was given a piece of chalk, measuring 39 mm. in length, and 12 mm. in diameter at its thicker end. The Sea-Urchin raised itself so that its teeth could be brought to bear on the rim of the narrower end of the piece of chalk, and it could clearly be seen to drive the points of its teeth into the chalk and then take the fragments into its mouth. The animal was still upon the chalk at 10 a.m. next day. The chalk was now removed for examination, and it was found that it had been bitten so that the portions shown in fig. 1, D had been removed. The peculiar impressions made by the teeth of the Sea-Urchin are also shown in the fig. (*d*, *d*). Small pieces of chalk are now given to the Sea-Urchins from time to time.

On seven occasions Sea-Urchins have been directly observed to bite repeatedly small pebbles, but without any effect so far as could be seen. The floor of that aquarium in which the twelve Sea-Urchins are contained is covered to a depth of about two inches with small pebbles; and it may often be that when the animals are stationary on the bottom, they are at that time engaged in biting the stones; but it is, of course, only possible to make sure of what they are doing when they are in favourable positions close to the glass.*

On reviewing the foregoing observations on the food and feeding habits of the Purple-tipped Sea-Urchin, one is struck by the very great variety of its foods, which range from fish to seaweeds, and excrement to shells.

4. The Search for Food.

Casual observation of well-fed captive Sea-Urchins, or of individuals in rock-pools, might perhaps give one the impression that it is the habit of a Purple-tipped Sea-Urchin to meander over the bottom of the sea and simply take the food with which it meets. If, however, a number of healthy and hitherto well-fed Sea-Urchins are starved for four or five days, their actions, when food is placed in the aquarium, show that the animals have quickly become aware of its presence and that they are searching for it. The first sign given by a Sea-Urchin that it has detected food is the extension and eager waving in the water of those tube-feet which are on the area of the animal nearest to the food. Indeed, a Sea-Urchin may sometimes be seen with those tube-feet which are nearest to the food extended and in motion, while those which are further away are contracted and quiescent. The next sign is movement, at first slow, but gradually quickening, in the direction of the food. This is usually accompanied or followed by protrusion of the extensile mouth-membrane towards the food, and alternate opening and closing of the teeth. In a journey towards distant food, a Sea-Urchin will laboriously

* It has long been known that *Echinus miliaris* can bore into certain rocks (see F. Cailliaud, "Observations sur les Oursins perforants de Bretagne," 'Rev. et Mag. de Zool.,' Ser. 2, T. 8, 1856, pp. 158–79); and there is a considerable literature relating to the boring of other species, such as *Echinus lividus*. The teeth are apparently the chief agents in boring.

surmount numerous obstacles, such as piles of rocks, which may lie in its path. Descriptions of two experiments upon the ability of captive Sea-Urchins to detect and eventually to reach distant food will here be presented.

First experiment.—A plan of the glass front of the aquarium is given in fig. 2. The tank contained about 26 gallons of thoroughly aerated sea-water, and the water was kept in constant movement by means of an air-pump. Of the twelve Sea-Urchins (which had been in captivity for twenty-nine weeks, and were perfectly healthy), four were visible, and the other eight were hidden behind the piled rocks at the back of the aquarium. Two of the visible Sea-Urchins, each of 23 mm. in diameter, were on the

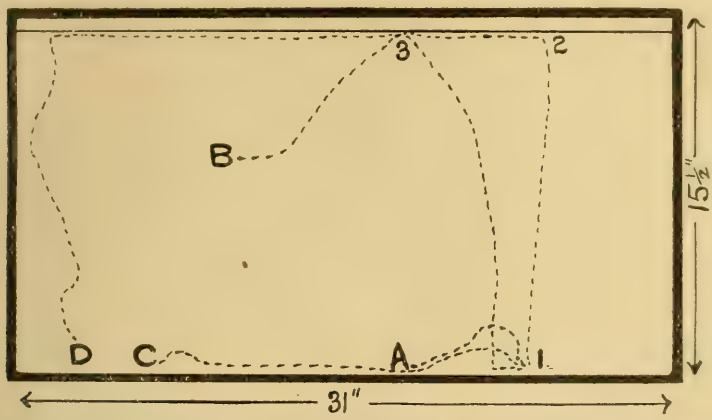

FIG. 2.—Plan of glass front of aquarium to show the routes taken by four Sea-Urchins when seeking *Laminaria*. Thick black line, frame of aquarium; thin line, surface of water; dotted lines, routes of Sea-Urchins; A, B, C, D, starting points of Sea-Urchins; 1, position of *Laminaria*.

glass at the places indicated by letters A and B; a Sea-Urchin of 16 mm. was partly imbedded in the pebbles of the bottom at C, immediately behind the glass; and one of 19 mm. upon the pebbles, also just behind the glass, at D. The time selected for the beginning of the experiment was when the Sea-Urchins were found in a quiescent state, in order that the first signs that the animals had discovered the presence of the food might be observed. Three large fronds of *Laminaria* were placed at 9.30 a.m. on the floor of the tank immediately behind the glass at the place numbered 1. The routes followed by the Sea-Urchins in travelling to the food are indicated by dotted lines.

Sea-Urchin A, which was 6 in. distant from the seaweed, showed the customary signs of excitement almost immediately after introduction of the food, and within about twenty seconds had begun to move towards it. It moved a little out of the direct path, as shown in the plan. It reached and began to eat the seaweed in the tenth minute after starting on its journey. Sea-Urchin B, which was 19 in. away from the seaweed, detected the presence of the *Laminaria* almost immediately after A. It at first went astray towards the surface of the water. At point 3 it turned quickly downwards again, and reached the food in twenty-nine minutes after starting. C and D, which were respectively 19 and 21 in. away from the seaweed, showed no signs of excitement until the twelfth minute. C then lifted itself from the pebbles and moved towards the food, at first quickly and then more slowly, reaching the seaweed in 160 minutes. D moved excitedly, but from the first wholly in the wrong direction. When it reached point 2, however, it turned downwards and travelled directly towards the food, but at what time it reached the latter was not observed, the only remark preserved in my notes being that it passed point 2 at 110 minutes after starting. The constant circulation of the water is perhaps the cause of the inability of the Sea-Urchins to go directly towards distant food. A Sea-Urchin of 10 mm., which hitherto had been completely hidden amongst the rocks, unexpectedly made its appearance after thirty minutes. This animal must have been fully 24 in. distant (in a straight line) from the food, to reach which it had to traverse probably not less than 4 ft. of rock surface. The exact time at which it reached the seaweed is not known. On the following morning two other Sea-Urchins, in addition to the five mentioned above, were found on the seaweed.

Second experiment.—The second experiment was made two weeks later, the Sea-Urchins again being starved for a few days; but in this instance the seaweed was suspended from the surface, and this had unexpected results. A view of the left portion of the contents, consisting mainly of piles of loose rocks, of the same aquarium is given in fig. 3. The reader is supposed to be looking through the glass front, and also somewhat downwards upon the bottom, of the aquarium, the bases of the piled rocks being about 2 in. from the glass. At the moment when the

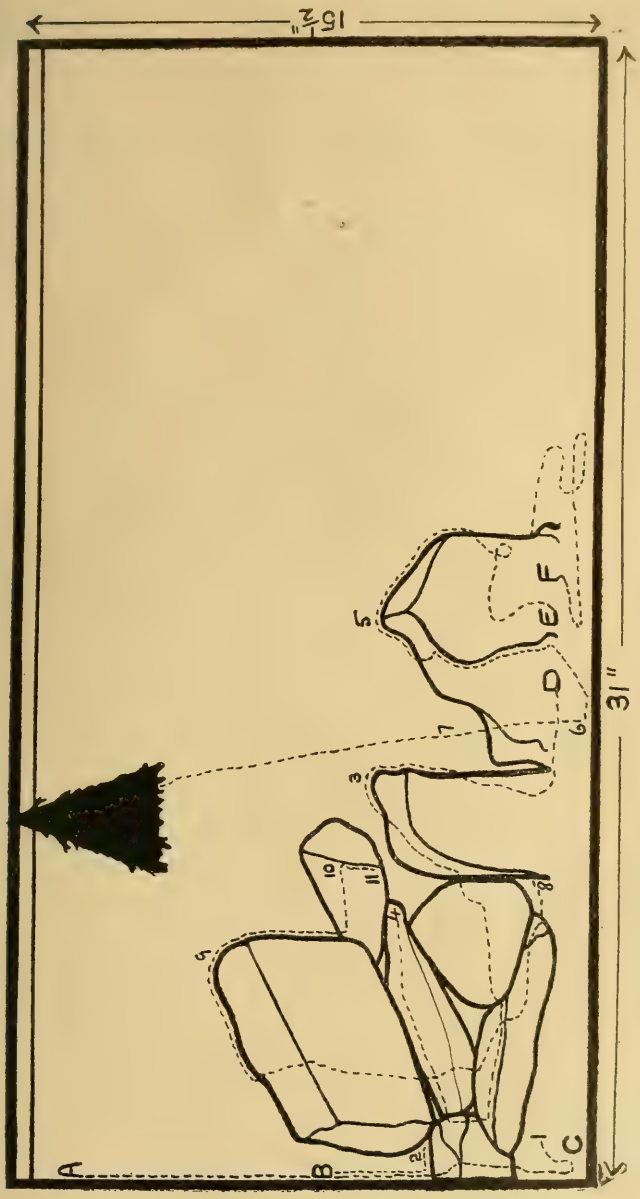

FIG. 3.—View of aquarium containing piled rocks, to show the routes taken by five Sea-Urchins when seeking *Fucus*. The bunch of *Fucus* is represented in black.

experiment began six Sea-Urchins—lettered respectively A, B, C, D, E, and F—were visible, A and B being attached to the left side of the tank, about 2 in. from the glass, and D, E, and F on the bottom between the base of the rockwork and the glass. At 10.30 a.m. a large, closely-tied bunch of fresh *Fucus vesiculosus* (represented in black in the fig.) was suspended from the upper margin of the tank in such a way that the widely-spreading ends of the fronds almost touched the glass. Sea-Urchin C was wholly occupied in biting an inverted Periwinkle, and it took no part in the proceedings described below.

Sea-Urchin A, 23 mm. in diameter, which was about 7 in. distant from the seaweed, showed signs of excitement in the course of the eighth and ninth minutes. It raised the lowermost part of its body towards the food, holding fast to the side of the tank by the tube-feet of its uppermost part; but as it found it impossible to leave the side of the tank, it naturally moved very slowly further and further towards the bottom. It reached the point numbered 1 on the bottom, after several stoppages in its course to attempt to find a direct path towards the seaweed, in 240 minutes after starting on its journey. Here it remained. Sea-Urchin B, of 27 mm., also moved very slowly down the side, reaching point 2 in 250 minutes. Here it too seemed confused, and gave up the search. D (27 mm.), E (23 mm.), and F (21 mm.) seemed to become aware of the food at nearly the same time as A, that is, about the ninth minute after introduction of the *Fucus;* but E from the first displayed the most eagerness of all the echinoids to reach the food. The persistence of these three animals in mounting rocks and lifting up a part of their bodies towards the inaccessible seaweed was very striking, and it must here be emphasised that whenever one of them reached the uppermost part of a rock it would remain there for a short time, as though vainly endeavouring to find a solid foothold which would enable it to reach the seaweed. D moved slowly and irresolutely along the base of the rocks, and then moved quickly to point 3, which it reached after 95 minutes. It searched the water with its tube-feet in the way just described for about one minute, and then moved slowly to 4, which it reached in 360 minutes. E travelled to 5 in 9 minutes, remained there for about 30 seconds, and then moved to the floor again.

It crossed the floor, and when it touched the glass at point 6 it climbed quickly up, stopping for 30 minutes at point 7 to eat part of a *Rissoa* which lay in its path. It then dropped the remains of the mollusc, and mounted quickly and directly to the seaweed, which it reached in 6 minutes after leaving point 7 and 142 minutes after starting. Sea-Urchin F first crept away behind the rocks, and, as it was believed that it had gone astray, its course was not for the time being observed. At 242 minutes after starting, however, it reappeared from behind the rocks at point 8. It traversed the rocks to 9, stayed there for 90 seconds with body raised and tube-feet waving; then it moved down to 10, where it stopped for a few seconds; it finally reached point 11 in 360 minutes. As it was now impossible to continue to make detailed notes of the behaviour of the animals, the seaweed was thrown amongst the rocks between points 3, 4, and 11. All the Sea-Urchins were upon the seaweed at 9.15 the following morning, with the exception of C, which was still upon the Periwinkle.

5. The Positions and Postures Adopted in Feeding.

The favourite method of feeding, if one may safely generalise from observation of sixty captive examples, is to enter into the heart of a bunch of seaweed, and particularly into the firm "roots" of such forms as have these in thick masses, and to remain ensconced there. Indeed, it is frequently to be observed that a Sea-Urchin, or several clustered Sea-Urchins, will remain in such a situation until the seaweed has become reduced to fragments and the animals surrounded by loose heaps of fæcal pellets. The Sea-Urchin will bite a hole in a frond of seaweed, but it usually begins at the edge or at a place where there is already a break or perforation.

A Sea-Urchin readily adapts its posture to the needs of biting food which is difficult to reach. One end of a long and narrow frond will often be held with spines and tube-feet against the teeth, in a way which absurdly suggests the smoking of a cigar, and then be gradually eaten away. In the case of a firm frond projecting from an otherwise inaccessible bunch, the animal will raise itself on its rim, so that its teeth

are at right angles to the floor, and then eat along the seaweed. A Sea-Urchin will often lie on its aboral surface whilst eating inconveniently placed material; and in order to hold and eat a bulky piece of food will sometimes climb a vertical rock with its mouth directed outwards. A living *Ascidia* of 30 mm. in length was placed upon the uppermost part of a Sea-Urchin of 23 mm., which was climbing up a vertical rock, and the Sea-Urchin, which seemed quite able with its spines to hold the smooth Ascidian, at first endeavoured to place its prey beneath the mouth, but the Ascidian was too bulky to lie between the Sea-Urchin and the rock. The Sea-Urchin then slowly turned completely over, holding firmly to the rock and the prey, and the echinoid began to eat the Ascidian as soon as the former lay with its mouth outwards. The whole process, from the time of placing the Ascidian to that at which the Sea-Urchin began to eat, occupied between nine and ten minutes.

If the food can be moved the Sea-Urchin will often arrange it conveniently under its teeth. A *Rissoa*, for example, is often, but not always, turned in such a way that the pointed end of the shell is directed towards the mouth, and the first (or first and second) whorl of the shell then bitten off. A few *Rissoæ* which had escaped after being so treated have been seen in the aquarium. As was pointed out on p. 88, the hinder parts of the shells of Mussels have been bitten by the Sea-Urchins, and it is probable that this part of the shell was selected because the echinoids were better able to seize with their teeth the narrow edges of the shells than they would be to seize a thicker part. The inverted gastropods on which the Sea-Urchins so often "sit" are probably turned over by the echinoids, though the latter have not actually been seen to do this. A straggling exoskeleton of a shrimp will be gathered into a compact mass beneath the mouth. A Sea-Urchin which found the tube of a *Sabella penicillus* (whose length was four times the diameter of the echinoid) inconveniently long, twisted the tube around its body. A Sea-Urchin of 10 mm. (carrying eleven pebbles of nearly one and a half times its own weight) remained for several hours balanced on a large horizontally projecting *Sabella*, in whose tube a hole was bitten.

6. The Time Spent in Feeding.

The length of time a Sea-Urchin will remain in one place to consume food has several times been incidentally mentioned. Four large individuals remained in a bunch of seaweed for two weeks, at the end of which time it was reduced to a loose heap of fæcal pellets; and five Sea-Urchins remained in another bunch for over three weeks. Three Sea-Urchins "sat" on a large dead Common Hermit-Crab from 10 a.m. on August 16th until 10 a.m. on the 19th, when, owing to its decayed state, the crustacean had to be removed from the water. A Sea-Urchin of 10 mm. remained in one place to eat the ray of a Sun-Star for two whole days, and another one sat on a living inverted Periwinkle for thirty hours. The Sea-Urchin of 19 mm., which ate part of the chalk, mentioned on p. 91, remained on the chalk for nineteen hours.

NOTES ON THE BIRDS OF LINLITHGOW LOCH.

By the Rev. J. M. McWilliam.

Linlithgow Loch lies about three miles south of the Forth, and about sixteen miles from Loch Leven, the breeding haunt of so many species of ducks. Being Crown property, it has the rare advantage of being a bird "sanctuary."

During nearly three years, from June, 1911, till December, 1913, I had constant opportunities of watching the birds that take advantage of its protection. I had previously been able to form some acquaintance, during the nesting season, with the birds of Loch Leven, where the Pintail and Wigeon, and, it is reported, the Gadwall breed; and as Linlithgow Loch is not very far from Loch Leven, I had hoped that I should find there some of the rarer ducks that nest regularly on the latter lake. I may say at once that the two lakes are more remarkable for the contrast than for the resemblance of their bird-population, though they are perhaps equally interesting; but I shall refer to this contrast later.

Linlithgow Loch is almost a perfect example of what complete protection can do for birds, under conditions in some respects disadvantageous. The lake is only about a mile in length, and a very few hundred yards in breadth. For almost its whole length it lies within a hundred yards or so of a town with a population of four thousand. There is a public park stretching to the edge of the water, and boats constantly out on the lake. And yet, in spite of these disadvantages, ducks of at least eight species can be seen there throughout a great part of the year. Unfortunately, too, there are only a couple of very small islands, and practically no available breeding ground of any kind. If it had been more fortunate in this respect it could hardly have escaped being a second Loch Leven as regards its breeding ducks; but, as it is, hardly any ducks nest here. It is only after the

nesting season that the lake is of interest. During part of the three years in which I worked this lake for birds I used a × 12 prism glass, but I soon found that something much more powerful was required; so for the remainder of the time I used a × 26–40 telescope. I was principally concerned with the ducks, but I took records of all of the more interesting birds that I saw. I have no doubt that my list of birds could be added to by any naturalist who gave more prolonged study to the lake. Indeed, I heard casual reports of others having been seen; but I found it difficult to get much accurate information, and so I merely give the results of my own work.

As I said before, it is only in the autumn and winter that many ducks come to the lake. I tried in each case to get the dates of arrival and to form as close an estimate as possible of the numbers of each species.

For the sake of accuracy these notes take the form of extracts from my note-book, written at the time of observation.

Pochard.—This is much the commonest species, about three hundred spending the whole winter on the lake, though none remain to breed. The earliest record that I have is for August 28th.

"August 28th, 1913. A small party of Pochards on the lake to-day."

"September 8th. About a dozen Pochards on the lake."

"September 14th. At least thirty Pochards on the lake."

"September 22nd. I counted seventy-six Pochards."

"October 13th. More than one hundred Pochards on the lake."

The majority of the Pochards, like the other diving-ducks, stay constantly at the deep west end of the lake, but some are always to be found at the other end with the surface-feeding ducks.

I watched a large flock through the telescope one morning in order to settle a point which seems to require to be cleared up. One sees it stated, from time to time, that ducks, while resting on open water during a breeze, keep their position by paddling in a circle with one foot.* I cannot see how anything could be gained by such action, as it is not possible to keep a boat from drifting by rowing with one oar from the side. However, I give

* See for instance Headley, 'Structure and Life of Birds,' p. 171, where this idea is fully elaborated.

some notes which I took, with this theory in view, while the birds were actually under observation through a telescope.

"One hundred and thirty-five Pochards sleeping on the water in a moderate breeze. About half of the number were resting, probably deliberately, in a patch of pond-weed where they would not easily drift, and did not seem to require to correct their position in any way. The remainder were resting further out, and they kept continually crossing and re-crossing the field of view of the telescope, first drifting a few yards, and then moving up-wind again. While doing so they always swam in a straight line, and kept their heads lowered as if asleep, *with their eyes closed.* I noticed one or two that seemed to be turning in the water, but this appeared only due to a chance breeze, and the birds seemed to gain nothing by the movement. Certainly there was no general turning movement to suggest that the birds kept paddling with one foot while sleeping. In fact, the Pochards did not seem to sleep very continuously. I constantly saw them raise their heads for a moment."

The Pochards are amongst the tamest ducks on the lake. They will swim quite boldly within twenty yards or so of people on the shore.

I regret that I did not take the relative numbers of males and females. My recollection is that the males were greatly in the majority, but little weight can be put on this after an interval of a couple of years. It is a point that could be settled in half an hour by any person who went to the lake.

Tufted Duck.—A very few, perhaps six or eight, spend the winter on the lake. The earliest record that I have is for August 24th. None breed on the lake.

Golden-eye.—These ducks are always to be seen during the winter. About twelve is the usual number, perhaps three to five of which are adult drakes, which seems to be an unusually large proportion. I cannot say that I have seen more than four drakes at one time. It is not uncommon to see a female feeding at the very edge of the lake, even at the Palace grounds, where people are continually walking about. Of course, nearly all of the ducks are very tame here, except the Wigeon, and in a lesser degree the Teal. The Shoveller, too, is hardly as tame as the Pochard or Golden-eye. I took the following notes about one

Golden-eye that seemed to be assuming full male plumage, though unfortunately I could never get very close to it:

"October 29th, 1913. I saw at least four Golden-eyes in female plumage, and one that appeared to be a male developing its full plumage. It showed a lot of white on the sides and back, and I thought, though I could not be certain, that I saw traces of the eye-spot.

"November 11th. I had a couple of Golden-eyes in view with the glass for some time at a considerable distance. They were both certainly drakes, but the eye-spot in one did not show as distinctly as in the other. Could this former be the bird that I saw on October 29th?"

October 27th is the earliest date that I have for this species. They always seem to arrive at the very end of that month. Curiously enough, I cannot remember having seen a drake at nearly so close a range as I constantly saw the females. They kept more to the middle of the lake. I am certain that I never saw one within gunshot.

Mallard.—Some scores of these ducks are to be seen in winter, and a very few breed on the lake. This is the only duck that I have seen here with young. I have seen two or three with a certain amount of white on their plumage. Doubtless these birds occasionally interbreed with tame ducks.

Wigeon.—A very few come, probably every winter. For a few weeks from October 22nd, 1913, I had a male and four or five females under regular observation. It is strange that so few of these birds, and so few Tufted Ducks, come to the lake. The latter is the commonest duck on Loch Leven, and the Wigeon breeds there in some numbers.

Teal.—About twenty Teal stay during the winter. They seem to assume full winter plumage earlier than most species.

"October 22nd, 1913. I saw several Teal, including half a dozen males in quite good plumage. The head had the chestnut and green markings, and the cream-coloured streak between. I saw about forty Shovellers, one or two of the males showing some signs of getting their winter plumage." The Teal were certainly very much in advance of the Shovellers in this respect. I should not have been surprised if Teal had not been found at

Linlithgow, as they do not breed on Loch Leven in any numbers, so far as I am aware, if they breed there at all. Doubtless they are to be found at Loch Leven in the winter, though this I do not know.

Shoveller.—This is one of the most interesting ducks on the lake. I fancy that the usual number is about forty. My earliest record is for August 22nd. I give a few notes as to the dates of their changing plumage:

"August 22nd, 1913. I identified a small party of Shovellers through the telescope. They were perhaps four hundred yards away, and I could see no difference in their plumage from that of Mallard ducks, but the size of the bill was quite obvious."

"October 22nd. About forty Shovellers, one or two of the males showing some signs of getting their winter plumage."

"October 23rd. Some of the Shovellers show distinct signs of getting their winter plumage."

"October 27th. The Shoveller drakes are fast getting their full plumage. Several of them have a considerable amount of white on the breast and chestnut on the sides."

"November 4th. Some of the drake Shovellers have practically full plumage."

"November 18th. It is certain that all of the members of a species do not change their plumage at exactly the same time. There are Shovellers on the lake in several stages at present. Perhaps the young of the year are the latest to change, and one would fancy that with the adults the time bears some relation to the date of their nesting. Birds which nest early would probably change their plumage proportionately early."

"November 22nd. I saw perhaps a dozen Shovellers, but none of them in nearly full plumage. Possibly they may only stay here during the transition, but they may quite possibly only have been away from the lake for the morning."

I have a strong suspicion, which unfortunately I had not the time to verify, that all of the Shovellers leave the lake as they complete the change. They became gradually less numerous through November, and I do not think that I ever saw one in absolutely full plumage. Possibly someone might settle this point. If it is as I suggest, it is a fact worthy of note, and there seems considerable reason to believe that it is so.

Goosander.—Several of these were to be seen on the lake during the winters of 1911–12 and 1912–13.

"November 6th, 1911. A flock of six Goosanders on the lake, one of them an adult male."

"November 18th, 1912. I saw to-day a flock of at least a dozen Goosanders on the lake, about half of them being males in good plumage."

In 1913, till I left in December, no Goosanders had appeared. The first that I saw in 1911 were on the lake the morning after a very heavy storm. They were magnificent birds, the whole flock keeping together, the birds diving and plunging through the water at a great pace.

Great Crested Grebe.—I have seen one or two on the lake from time to time, but they are only stray visitors and never nest, though there is some suitable cover for them if they wished to do so. I saw this species on November 18th, 1912, and on September 16th, 1913.

Little Grebe.—There are one or two pairs of these. I believe that I have seen the young.

Coot.—Common and resident.

Waterhen.—Common and resident.

Cormorant.—These are constant visitors to the lake. I have seen three or four at a time sitting on the trees on the little islands. They constantly fly to the lake from the Forth, and fish for an hour or two before leaving.

Heron.—These are constantly to be seen at every season of the year, but they do not nest.

Snipe.—I have seen three or four of these at different times.

Sandpiper.—I have seen these on several occasions.

Redshank.—I have seen very few. On October 29th, 1913, I saw a flock of three or four.

Gulls.—The Herring-Gull, Common Gull, and Blackheaded Gull are to be seen constantly, the Herring-Gull being in flocks of hundreds at times. The Lesser Black-backed Gull is numerous in spring, but I cannot say that I have seen it in winter. The Great Black-backed Gull comes in small numbers, usually, I believe, in winter. Sometimes I could not decide which of these two latter species I was watching through the

glass, but I could generally identify them by comparing their size with that of Herring-Gulls swimming beside them.

I have seen a very few Terns from time to time, but never sufficiently close to decide whether they were Common or Arctic.

This forms the complete list that I was able to compile of what might reasonably be described as lake birds.

The contrast in many respects between the Ducks frequenting this lake and those of Loch Leven struck me. I never saw or heard of either Pintail or Gadwall on Linlithgow Loch, though they breed on Loch Leven. The Tufted Duck is the commonest breeding bird on Loch Leven, and half-a-dozen only were to be seen at Linlithgow. Wigeon breed regularly at Loch Leven; they were very rare at Linlithgow. Teal were common on Linlithgow Loch, and they certainly do not breed commonly on Loch Leven. The Shoveller and the Mallard were the only two whose status on the two lakes seemed to be about the same. They were both reasonably common on each. The Pochard was the commonest Duck at Linlithgow Loch. I believe that it breeds on Loch Leven, but probably not commonly. Of course, I am writing only from experience of Loch Leven during the summer; but still it is surprising that so many Ducks that nest regularly there seldom or never come to a lake only sixteen miles distant that is so much frequented by other species as Linlithgow is. On a few occasions I was puzzled in identifying certain birds at Linlithgow, but I certainly never had a clear view of Ducks other than those that I mention.

I do not know if I have made it quite clear just how interesting the birds of Linlithgow are. It is the commonest thing to have Ducks of five or six species in view at the same time. For months during the winter there is hardly a day when there are not some hundreds of Ducks to be seen at a reasonable range. One can examine by the hour birds that in most other places are almost unapproachable. The only regret of the naturalist is that there is no suitable breeding-ground. If the lake were even in the hands of a private owner who was interested in birds this could easily be remedied to some extent. But, as things are, there must be few places in Britain that give opportunities for bird-study of the same kind. I have no doubt that the

list of birds that I have given is imperfect. In working out even the easier problems in natural history it is seldom that one has not to leave much unfinished. Perhaps someone may complete these records in the future. In fact, there are few things more interesting to an ornithologist than the changes that have taken place of recent years in the status of many of the British Ducks. Several species that were quite rare a generation ago are now amongst the commonest; and I suspect that some species, such as Mallard and Teal, are in many places rarer than they used to be. It would be of substantial interest if a more or less continuous record could be kept of the Ducks in some particular place, such as Linlithgow Loch, which is not much affected by changing local conditions. The numbers of the different Ducks that I have given were ascertained as carefully as was reasonably possible. What will be the relative numbers of the different species in, say, ten or twenty years? Perhaps some person who is permanently resident in the district might continue these records. From the peculiar situation of the lake it could be done without much difficulty.

THE YELLOW-NECKED MOUSE IN SHROPSHIRE.

By Frances Pitt.

This handsome variety or sub-species of the Long-tailed Mouse (*Apodemus sylvaticus*) was formerly considered rare in Shropshire, only two or three isolated examples having been taken; but in the summer of 1913 I found that *A. flavicollis wintoni* (Barrett-Hamilton) was very common in this neighbourhood, *i. e.* the district around Bridgnorth.

I have taken many specimens alive and kept them in captivity, and have had the pleasure of noting several interesting facts concerning them. In life the difference between the two races is far more marked than an examination of a series of skins would lead one to suppose, and its superior size, brighter colouring, longer tail, its heavier build, and the fawn collar, from which it takes its name, make the Yellow-neck by far the handsomer Mouse of the two. There is no difficulty in distinguishing it, even when running about, and the typical *sylvaticus* appears dull and dark beside its larger relative. It is *flavicollis* which is the "Greyhound Mouse" of the country-people, and they have good cause to know it, as it is a most determined thief of such things as peas, potatoes, etc.

Nearly all the Yellow-necks that I have caught have been taken in the house, usually in the larder and cellar, where it has been quite the exception to catch a Long-tailed Mouse, though a trap set out of doors has been just as certain to capture a Long-tail. I have many times placed a trap beneath a bush in which some old bird's-nest bears witness, by the remains of the berries it contains, that there is a Mouse about, but the result has invariably been the capture of a *sylvaticus*. But it is different when you get to the neighbourhood of buildings, where the chances seem to be equal, and inside (failing the Common House Mouse!) it is just as certain to be a Yellow-neck.

YELLOW-NECKED MOUSE, MALE (LIFE-SIZE).

Apodemus flavicollis wintoni (BARRETT-HAMILTON).

Photo. by F. Pitt.

The proportion of the sexes in this neighbourhood seems to be about equal (I understand that observers in other parts of the country have found a preponderance of females), and the evidence points to the adults going about in pairs, for whenever I have trapped a Mouse of one sex I have invariably taken another of the opposite sex on the same spot shortly after. Once I caught them together! Something had been eating holly-berries on a bedroom window-sill, and suspecting a Yellow-neck I put, not having a proper trap handy, an ordinary box-trap baited with a piece of cheese—by the way, though Long-tailed Mice of both races refuse cheese when offered them as food, yet it is the best of all baits; the reason, I suppose, being that they can smell it so far away, and enter the trap to see what it is. On this occasion it was most effective, for in the morning there were two of the finest Yellow-necked Mice that I have seen, tightly wedged in the little trap. They were quite unhurt; even their long tails were not damaged, but how they had both got in I do not know. I put them in a cage and kept them for some time, until they escaped, through an accident. They were beautiful creatures to watch, being wonderfully graceful in their movements and most particular over their toilet; they would sit up and clean themselves in the daintiest manner. It was astonishing what high jumps they took when endeavouring to reach the roof of their cage. I provided them with small sticks and twigs, among which they performed all sorts of acrobatic feats, and there can be no doubt that the Yellow-necked Mouse and the Long-tailed are both quite as much at home up aloft as the more obviously arboreal Dormouse. I have frequently found Long-tails in nests that had been made by the latter species, and as I have seen a Long-tailed Mouse come out of a nest which only the day before had held a Dormouse, I think the presumption is that they often turn out the rightful owners.

When caged the Long-tailed Mouse is usually a most gentle creature, ready to welcome in a friendly fashion any stranger of its own species that may be introduced, and tolerant of other Mice; but my experience of the larger race is that they are far from being so amiable, and my captives have shown so much animosity towards their smaller relatives that I doubt

the two races inter-breeding much under natural conditions. The presence of Mice of an intermediate type (but such are far from common), and the fact that I once found a typical *sylvaticus* and a typical *flavicollis* living in the same nest in a bee-hive—the little wretches had destroyed all the bees!—suggests that such crossings may occasionally take place; but I have also known Yellow-necks kill and eat the smaller Mice. In January, 1914, I put seven Mice in one large cage. There were four Yellow-necks, one Mouse of the intermediate type, and two Common Long-tails. At first, as far as I could see, they agreed quite happily, but on the second day I found the Mouse of intermediate type dead and partly eaten. In two days another one was killed. This was a small male that was really rather of the intermediate type than a true Yellow-neck. Then I investigated the matter. I found a fine old male *flavicollis* with two females in a nice nest in one corner of the cage and the *sylvaticus* pair at the opposite end, where they also had made a nest. One of them had been bitten, and I removed them and put them by themselves. Thinking the matter over, I thought it might only be a case of a big powerful male bullying the smaller ones; so I decided to see what would happen to a Short-tailed Meadow-Vole, for if it were only a case of the males fighting they would surely not interfere with a Mouse of a different species. I put the Vole into the Yellow-neck's cage and awaited events. It ran about and nibbled at the grass which I had provided for it, and soon one of the big Mice peeped out of the domed nest. Its great beady eyes looked this way and that, and its nose worked in a manner that showed it smelt a new-comer. Very cautiously it stepped out, paused and sniffed, then with a bound it attacked the Vole. There was much squeaking and scuffling, and the poor little stranger was chased round the cage, and I have no doubt would have been killed had I not interfered and rescued it; but it had already been bitten in the leg.

It seems that the Yellowed-necked Mice are intolerant of the presence of Mice of other species, and even object to nearly allied forms. Surely this trait in the character of the race will be a powerful factor in bringing about segregation? And that *flavicollis* and *sylvaticus* are an example of how two varieties

inhabiting the same locality will split into well-marked and distinct species by reason of the preference like has for consorting and breeding with like?

To go back to the Yellow-neck in Shropshire. I think that this Mouse and the Long-tail have two migrations—namely, from the neighbourhood of the farm-buildings and stacks in the early summer to the woods and open fields, and a return migration in the late autumn when the supply of berries, etc., runs short. Many, of course, do not leave the woods and hedges, but these are chiefly of the *sylvaticus* type. I have never caught a Yellow-neck in the open in the winter, though I have taken many Long-tails. And the same applies to the Mice which are ploughed up in the stubbles during the autumn ploughing, many dozen of which have passed through my hands; but they have all been of the dull, dark *sylvaticus* type.

By the way, though the young *flavicollis* in its first pelage resembles the smaller variety, yet it can easily be distinguished, for the mark across the throat and chest which afterwards becomes the distinctive fawn collar is visible even at this early age as a darkish grey streak.

Apropos of the difference in size between the adult Mice of the two varieties, I may mention that, whereas the Long-tail can get out easily and without much squeezing through the small wire netting which is known as "½ in. meshing," yet the Yellow-neck is safely imprisoned by it, and with his bigger skull cannot pass through. As series of measurements may be found in any text-book, I do not propose to give any here, but will only say that in life the difference in size is as obvious as that between a small pony and a big cob.

The distribution of this handsome Mouse does not seem to be very well worked out. It is known that it is scattered sporadically through the south and west of England, but I am convinced that in many localities it is overlooked, so I should be very glad if anyone who has met with it would communicate with me.

NOTES AND QUERIES.

MAMMALIA.

Dissimilar Eyes in Human Subject.—A short time ago I noticed a girl of about twelve years of age with a striking peculiarity—her eyes were not alike: one being dark blue and the other dark brown. Apart from this she was quite ordinary—black eyebrows and lashes, a bright healthy complexion, and thick brown hair.—(Miss) F. R. Holloway.

AVES.

Missel-Thrush Feeding at London Window.—On the snowy morning of February 24th, I put some crushed biscuit on my window-sill, in hopes of attracting a pair of Starlings which reside in this region of small back-yards (Chalcot Crescent, N.W.), as well as the Sparrows. They did not come, but to my great surprise, a Missel-Thrush did, and after eating some biscuit, came again in about half an hour, accompanied by another; these birds showed even less nervousness than the Sparrows, and after feeding remained a little time on the neighbouring trees, but they did not appear again, though I had the food ready next morning. Probably they left the neighbourhood; I saw three flying south over Euston Road about noon that day. In so shy a species such tameness seems to be strange, though the few Regent's Park Missel-Thrushes are, of course, used to the sight of people; I have, however, never seen any Thrushes at all from this window before, though Blackbirds not infrequently appear, and I have seen one feeding in a yard.—F. Finn.

The Little Owl in Sussex.—The Little Owl (*Athene noctua*) first came under my notice in this district in April, 1913, but I failed to authenticate it at that time, and it was not until last December (1915) that I again met with it, when on the 28th of that month I saw one in Buxted Park. I found it at the same spot on the following day.—Robert Morris (Uckfield, Sussex).

A Sussex Marsh-Harrier.—On October 26th last there came into my possession a fairly well-mounted immature Marsh-Harrier (*Circus æruginosus*), shot some years ago by the late Mr. William

Sturt at Crosbury, Little Horsted, Sussex. It was purchased at a sale of the effects of the late Mrs. Sturt at Jarvis Brook, Crowborough, some few days previously. Mrs. Green, of Hove, very kindly offered to obtain some information as to the year in which it was obtained, and wrote her brother, Mr. Charles Sturt, who, though he well remembered the bird being brought home, could not give the date, further than it was between forty-five and fifty years ago. Judging by the plumage I suppose it to be a male. I thought it as well that this should be recorded.—ROBERT MORRIS (Uckfield, Sussex).

CRUSTACEA.

Ecdysis in a Hairy Hermit-Crab.—The habits and the rate of casting of the exoskeleton of the hairy Hermit-Crab known as *Eupagurus pubescens* seem to have been little observed in captivity. An average-sized individual in an aquarium cast its exoskeleton on July 7th, and again on August 18th, of 1915. The animal was healthy, and fed eagerly on pieces of mussel and beef. It disappeared on October 26th without having cast again, and presumably it had either escaped from the aquarium or been torn to pieces by the larger Common Hermit-Crabs in the same tank. The number of clear days which elapsed between the two castings was therefore forty-one. Sixty-eight clear days elapsed from the date of the second casting to that of the disappearance of the Hermit-Crab.—H. N. MILLIGAN.

Shore-Crabs Attacking Opelet Sea-Anemones.—On September 9th five average-sized individuals of the Shore-Crab (*Carcinus mænas*) were placed in an aquarium. On the 16th about twenty examples of the Opelet Sea-Anemone (*Anthea cereus*), varying in size from half an inch to three inches and a half across their extended tentacles, were placed in the same tank. The Shore-Crabs have never hesitated to attack the Sea-Anemones, and to tear off, and in some cases actually to eat, their tentacles. The Shore-Crabs would also rob the Sea-Anemones of food by thrusting their claws amongst the tentacles, or into the food-cavities, of the Sea-Anemones and dragging out the food recently taken. The Shore-Crabs never seem to sustain any damage in these encounters, or even to be perturbed in any way by the presence of nematocysts when they take the tentacles into their mouths. The Sea-Anemones underwent so much persecution that on November 16th they were removed from the aquarium. The curious mixture of delicacy and hardiness so often displayed by the Opelet Sea-Anemone in captivity is well known, and it is interesting to observe that in spite of persecution these coelenterates are still

(December 23rd) nearly all alive and flourishing, that the wounded stumps of their tentacles have closed up, and that the tentacles are apparently beginning to regenerate.—H. N. Milligan.

INSECTA.

Butterfly Abroad in Dull Weather.—Two or three years ago I noted, on a dull drizzly day, a large white Butterfly flying along the window-boxes in a London street, feeding on the flowers, exactly as if in sunshine.—F. Finn.

ASTEROIDEA.

Starfishes Feeding on Hermit-Crabs.—Dr. Bolau has recorded (Kleinere Mitteilungen, in "Der Zoologische Garten," vol. xlvi, 1905, p. 53) his astonishment on discovering that his Starfishes fed on living Hermit-Crabs in an aquarium. I have fed Common Starfishes with dead Hermit-Crabs, and have found that they are readily taken. One Starfish "sat" from the morning of December 3rd until the morning of the 4th on a *Turritella* shell in which there was a healthy Hermit-Crab of the species known as *Eupagurus pubescens;* but it seems that the Starfish had merely fastened its stomach on the shell, not on the Hermit-Crab itself, and the latter appeared to be none the worse for the encounter when I released it from the grasp of the Starfish on the 4th. Earlier in the year I gave a sluggish Common Hermit-Crab (*Eupagurus bernhardus*) of average size to a Starfish of medium size at 10.15 a.m., and the former was at once attacked by the latter. The Starfish humped over the shell of the crustacean; fixed the shell firmly in the angle between the glass front and the floor of the tank, by fastening two arms to the glass and the other three to the floor; and then it pulled the Hermit-Crab bodily from the shell. The Starfish quitted its prey at about 10.15 a.m. on the following day. It was found on examination that the skin of the crustacean had been punctured at the place where the abdomen joins the thorax, and the greater part of the soft contents of the abdomen and the thorax had been extracted, leaving little but the empty exo-skeleton. This is an excellent example of the way in which the Common Starfish will pass its stomach through a small opening in the body of prey and search its interior. The emptied abdomen of the Hermit-Crab collapsed when it was lifted from the water, but the abdomen had not been separated from the thorax.—H. N. Milligan.

NOTICES OF NEW BOOKS, ETC.

A Monograph of the British Marine Annelids. Vol. III. Part I.—Text. Part II.—Plates. By PROFESSOR W. C. MCINTOSH, F.R.S., etc. London: Dulau & Co., Ltd. 1915. Price 25*s.* each.

THE present instalment of the Ray Society's well-known monographs deals with the Polychæte marine Worms of eleven families, from the *Opheliidæ* to the *Ammocharidæ*, including over eighty species. Thus, as is said in the Preface, "in this Part economically valuable forms, such as the Arenicolids and Spionids, brightly phosphorescent types like *Chætopterus*, the most cosmopolitan of all the boring groups, viz. the Polydoræ and Dodecaceridæ, the complex and physiologically interesting *Magelona* and the Capitellidæ, and, lastly, the numerous and peculiar family of the Maldanids, fall to be considered." Professor McIntosh, in an admirably concise and lucid style, deals most fully with the structure, colours, habitat and habits —where ascertainable—and anatomy of these interesting organisms, and many facts of interest to the general naturalist, as well as to the student of marine life in general and of annelids in particular, come to light in the course of the work. It is interesting, for instance, to read of the familiar Lob-worm (*Arenicola marina*) of such importance to fishermen for bait, that the process of breaking up and fixing it for this purpose is so trying to the fingers, unless dipped beforehand in a solution of alum, that they soon bleed owing to the friction and the secretion produced by the worms; and that the hæmoglobin in the blood of these differs little from that of such a different creature as the Horse. Of the curious tube-living *Chætopterus variopedatus*, so remarkable for its enormously-developed and greatly-varied appendages, "it is," says Professor McIntosh, "most beautifully phosphorescent, bright flashes being emitted from the posterior feet, but the most vivid light occurs on the dorsum, between the great sickle-shaped lobes which curve forward over the first region of the body. Here the phosphorescence is intense, and the copious mucus exuded by the animal can be drawn out as vivid bluish-purple fire which, besides, now and then gleams along the edges of the wing-like flaps, illuminating the water around." Although commonly found in deep

water, this interesting worm occurs, at Herm, under stones in pools between tide-marks. The synonymy of the groups dealt with is most completely and conveniently given, the references being given strictly in chronological order, a plan which, though it uses up a good deal of space owing to the consequent repetition of names, more especially as each reference has a line to itself, is thereby of great assistance to the ready finding of a particular reference. It is worth noting that the common *Arenicola marina* was described as *Lumbricus marinus* by Belon as long ago as 1553; and the references to it between that date and the present day fill up no less than five pages of this publication in quarto—a most unwieldy size, by the way.

Part II. contains the plates illustrating Part I., the only illustrations in which volume are line drawings in the text illustrating anatomical and other details. These plates, numbered lxxxviii to cxi, depict both the whole animals and various details of structure, such as bristles, etc., and are most beautifully executed, reflecting the greatest credit on the artists, Miss A. H. Walker and the late Mrs. Albert Günther. Six of them—lxxxviii. to xciii—should have been in colour, but owing to the war it has proved impossible to get these through, and so all have, very rightly in our opinion, been issued in black and white, to render the text at once available to workers. If ultimately obtainable, the coloured plates are to be sent to subscribers for 1916. We might suggest that these would find it interesting and useful to colour these black and white plates themselves, as opportunities occur of getting living specimens. We have here a small criticism to make—the degree of magnification is generally given in the detail figures, but those of the whole animal are generally spoken of merely as "enlarged"; a more precise indication of the degree of enlargement would, we think, have been of service to collectors unused to this group. We should like especially to draw attention to the figures of the extraordinary pinnate bristles of *Poecilochætus serpens* given on the last plate; these are so extremely like feathers of the simple type consisting only of shaft and barbs, such as some of the Emu's, that no one could, on seeing these drawings alone, think they could have been meant for anything else.

The Invertebrate Fauna of Nottinghamshire. By Professor J. W. Carr, M.A., etc. Nottingham: J. H. Bell, Ltd. 1916.

This compact and well-got-up volume is published for the Nottingham Naturalists' Society, which completed its fiftieth year in 1902, and testifies both to a superabundance of vitality in an

association which can at this time issue a local faunal list running into six hundred pages, and to plenty of energy on the part of its compiler, who is Professor of Biology in Nottingham University College.

The lists of Invertebrates contained in it are the outcome of a Jubilee Fund raised by the Society in 1902, and of vigorous systematic field work taken up with this object. "It does not pretend," says Professor Carr, "to be more than a contribution towards the fuller knowledge of the Invertebrate animals of the county, but it will at any rate be of use in showing what has been accomplished and what remains to be done," and he hopes that its publication will stimulate others to take up the study of the Nottinghamshire local fauna. Great care has been taken to have the specimens concerned named by special authorities on the several groups, and the notes as to first occurrence, abundance, or otherwise, under the various species are, or may be in the future, sometimes of more than local interest. It is interesting, for instance, though rather depressing, to read under the heading of *Aphantopus hyperanthus* (the Ringlet) that it, like many other butterflies; has disappeared from districts in the county where it was formerly common.

The Emu, vol. xv, Nos. 2 and 3, October, 1915, and January, 1916. Melbourne: Walker, May & Co.; European Agents, Witherby & Co., London. 4*s*. each.

We have pleasure in welcoming these, the first numbers of the 'Australian Ornithologists' Union's Quarterly' which have reached us for review, and find considerable interest in some of the papers, such as Mr. A. H. Chisholm's notes on the Yellow-bellied Shrike-Tit (*Falcunculus frontatus*), which is illustrated by photos of the nest, a very deep cup built among twigs, made chiefly of the inner bark of eucalyptus. This is a quite unusual sort of nest to anyone used to our Tits; but tearing at bark is all in the day's work for this bird, whose remarkably powerful and shrike-like bill is used largely for hammering and tearing at bark, not for aggression on other birds; indeed, it seems the introduced Sparrows follow these Tits—which are much larger than our Great Tit—and dash in to steal some of the results of their work. The curious name of Yellow-hammer has been given to these birds, just as it has been in America to a Woodpecker, the Flicker (*Colaptes auratus*), for both birds hammer, and show yellow in their plumage, and the colonists had evidently forgotten all about our Yellow-hammer but the name. An interesting little note

by Mr. Le Souëf follows this and relates another aggression by introduced birds upon natives, in which a pair of the well-known "Laughing Jackass" (*Dacelo gigas*) were evicted from a nesting-box, which they had already used at least once, by Starlings. But in this case "the return of the native" was in the nature of reprisals, for the big Kingfishers ultimately came back and ate up the young Starlings—why they did not thus treat the old birds is a puzzle. Over twenty-eight pages and several plates in this part are devoted to a paper by Dr. J. R. W. Shufeldt, of Washington, on the comparative osteology of Harris's Cormorant (*Nannopterum harrisi*)—an interesting species, because flightless and of recent discovery, but as it comes from the Galapagos, the paper seems rather out of place in a journal meant to "popularise the study and protection of native [Australian] birds." A note on the singular little quail-like Plain-wanderer (*Pedionomus torquatus*), the only four-toed Hemipode, indicates that this, like some of the true Quails, is apparently partly nocturnal, and is illustrated by a fine photograph of this species, now, alas! declining, in a characteristic tip-toe attitude. On the next page a very clear and beautiful print illustrates the tameness of one of four Laughing Jackasses, which have formed a habit of coming to the doorsteps of some of the residents of Upper Fern-tree Gully, Victoria, to feed on raw meat placed for them there; it is the work of Messrs. Littlejohns and Lawrence. In the January number there are some nice studies of the nesting of the charming tiny Mistletoe-bird (*Dicæum hirundinaceum*), illustrating a paper by the same observers; this species, we may remark, can be seen alive at the Zoo at present. There are several other studies of nests of Australian birds, of which the best and most remarkable is that of the Lemon-breasted Flycatcher (*Micræca flavigaster*), a structure which "is about the circumference of a half-crown and the receptacle of a single egg"; it is noted by Mr. A. J. Campbell. On the last page the editors observe that "a recent criticism stated that 'The Emu' was neglecting popular ornithology and was becoming too technical. The editors are keenly alive to the necessity of developing popular interest in Australian birds, and have not lost sight of that plank in the Union's platform. All papers dealing with the popular side of ornithology that have reached the editors have been printed in full." No doubt the splendid support Australia and New Zealand are giving us in the war has caused a falling off in bionomical contributions owing to the absence of many who would otherwise have contributed notes, but it struck us too in reviewing

these numbers that there is a good deal more about nomenclature published than any practical ornithologist can be expected to stand with equanimity, while previous volumes of 'The Emu' have appealed to us as veritable mines of observation, so that we are not astonished at the criticism referred to.

The Auk. Vol. xxxiii. No. 1, January, 1916. American Ornithologists' Union, Cambridge, Mass. 75 cents.

THOSE interested in the duck tribe and in bird problems in general will find the papers of Dr. C. M. Townsend and Mr. John C. Phillips, appearing in this number of the great American ornithological quarterly, of unusual interest. Dr. Townsend records his observations on the courtship of the Merganser, Mallard, Black Duck, Baldpate, Wood Duck, and Buffle-head. The Merganser dealt with is the Goosander (*Mergus americanus*), a local race of the Old World bird rather than a full species; that of the Mallard is of course well known to us. In describing it Dr. Townsend does not mention the up-jerk of the stern which follows as a rule the rear-up of the drake. In the courtship of the Black Duck (*Anas rubripes* *), a species in which both sexes are very like female Mallard, but much darker, the male often flies for short distances over the water, as indeed does the Mallard, but less frequently. The Baldpate, which is our rare visitor the American Wigeon, displays very similarly to our bird, but apparently has a softer note; its ordinary note, certainly, as we have observed in captives here, is softer and has more syllables than our Wigeon's. The Wood Duck (*Aex sponsa*), the bird known to us in domestication here as the Carolina Duck, is described as bobbing his head up and down in an abbreviated bow, and erecting his crest. As we have seen him display, the action is quite different, the crest being actually flattened down, while the head and tail are raised and kept so in a rather stiff manner. The Buffle-head, when courting, an action believed by Dr. Townsend to be here described for the first time, "spreads and cocks his tail, puffs out the feathers of his head and cheeks, extends his bill straight out in front close to the water, and every now and then throws it back with a bob in a sort of reversed bow." Mr. Phillips brings to notice a very remarkable record of migrating waterfowl, the capture of three species of American ducks in the Marshall Islands, north-east of New Guinea. These were the Pintail, Green-winged Teal (*Anas carolinensis* *), and

* *Anas obscura* and *Nettion carolinense* of the British Museum Catalogue.

Canvas-back (*Nyroca vallisneria*). These birds never occur in Australasia or Polynesia, and yet large flights of duck are said to pass the Marshalls for days in autumn, going from north to south and dropping stragglers to rest, while they return north in May. The story is over ten years old, and a German one at that, published in the 'Ornithologischer Monatsbericht'; but as the Marshalls are now in our hands, we may expect ere long some evidence on the subject from our own fellow-countrymen.

EDITORIAL NOTES.

Odd Eyes in Man, etc.—Such differences in the colour of the two eyes in humanity as Miss Holloway records on p. 112 are rarely observed, but we can, curiously enough, record four cases in which we have seen this abnormality. In 1892 we saw a man, with dark hair and moustache, with one eye grey and the other brown; we did not note the variation again till recently, when within the last few years we have seen a fair man with the same peculiarity, and also a woman, the colour of whose hair we did not notice. The last case that has occurred to us is that of a little girl of eight we saw last year, whose hair was fair. In her, as in the others, one eye was brown, the other being blue. One "wall"—very pale blue—eye, in contrast to the normal brown, may be seen in Dogs, Horses, and Rabbits, and white Cats may have one eye blue and the other green. Considering the great variability in iris-colour in birds, it is rather curious to find odd eyes so rare among them; we have only noted one case, a red-and-white tame Pigeon, with one brown eye and one white or "pearl" one. In this case the two sides of the head were also marked differently, so that different views of the bird gave the impression of two quite different individuals; but we noted no asymmetry other than that of eye-colour in the human cases above referred to. We have never noticed any instances of odd-coloured eyes in reptiles, amphibians, or fishes.

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THE ZOOLOGIST

No. 898.—April 15th, 1916.

BIRDS SEEN DURING THE DARDANELLES CAMPAIGN.

By Captain A. W. Boyd, M.A., F.E.S.

During the Dardanelles campaign I kept note of the species of birds seen, and with the help of Messrs. J. L. Bonhote and M. J. Nicoll, of Cairo, and Mr. T. A. Coward, have subsequently been able to determine the species of the majority of those which were new to me; the impossibility of collecting any specimens has, however, made the identification of quite a number entirely out of the question, and this refers particularly to the Warblers. I was present on the Gallipoli Peninsula from May 5th to September 5th and from October 16th to December 27th, 1915, and on a boat anchored off the Cape from September 5th to 13th; on Lemnos from December 28th, 1915, to January 15th, 1916; and on Imbros, July 9th to 13th, 1915. I include in the following notes the birds seen on these two islands.

On our arrival in May, migration was still going on and continued till after the middle of the month, when there was a very noticeable movement of Shrikes; from that time there was little movement till the second week in August, but by the end of that month migration was in full swing: Short-toed Larks and Yellow Wagtails were passing in great numbers; a few Hoopoes and Bee-eaters appeared; and Swallows were present in greatly increased numbers. I was unfortunately absent from the Peninsula during the latter half of September and the first half of

October, and therefore missed the most interesting period of migration, but the autumn migration was still proceeding in the second half of October, and the passage south of hundreds of Storks and the presence of multitudes of White Wagtails attracted everybody's attention.

Winter residents arrived early in November, especially noticeable being Grey Wagtails and Black Redstarts, while Stonechats came first in October; but a cold snap—the last four days of November—caused a quite remarkable influx of species not seen before: Skylarks and Starlings, Robins and Hedge-Sparrows, Woodlarks, Chaffinches, Blackbirds, etc., etc. On December 1st the frost broke, and there was a continual passage all morning of small birds going north-east up the coast—Starlings, Skylarks, Goldfinches, Pipits, and many others.

Many birds continued to breed on the Peninsula, and seemed to be far more disturbed by the troops everywhere than by the guns and shells; I never had the opportunity to look for nests, but a number of summer residents bred there, such as Shrikes, Bee-eaters, etc., and the ordinary resident birds were to be seen to the end.

A great part of the Peninsula at the Cape Helles end is a heathery upland, broken by several nullahs, and there are not many trees except in the centre and on the south side by the water-towers and near the Dardanelles, where the French troops were; naturally I was seldom able to visit that side, and was never there later than the middle of August; if I had been there frequently I should doubtless have been able to add a good many species to the list. On the north-west coast is a shelving cliff where shrubs and trees grow, but there is no beach or mud-flat where waders or sea-birds may be seen; consequently the only sea-birds noticed were off Cape Helles, or passing along the coast.

Of course, the following list only contains birds seen casually, and many birds seen on perhaps one occasion or not at all were probably quite common a short distance away. Considering the fact that all that part of the Peninsula occupied by us was continually under fire for eight months, the number of birds to be seen daily was quite remarkable.

On Imbros in the summer the birds were similar to those

seen on the Peninsula, but were far less disturbed; on Lemnos also in the winter they seemed to be largely of the same species, but there was a good mud-flat beside Mudros Harbour where waders were to be seen.

The following is a list of the species seen. The nomenclature used is that of Dresser's 'Manual of Palæarctic Birds' (1903):

MISSEL-THRUSH (*Turdus viscivorus*).

From October 19th to 23rd small bunches passed over, flying north and north-east.

FIELDFARE (*Turdus pilaris*).

One at the top of the cliff on November 29th during the cold weather.

BLACKBIRD (*Turdus merula*).

A male in the scrub on the cliff-side on November 27th: several on December 1st, and daily to December 5th.

COMMON WHEATEAR (*Saxicola œnanthe*).

Very common throughout the summer; seems to nest commonly. Seen on Imbros commonly in July.

BLACK-THROATED WHEATEAR (*Saxicola melanoleuca*).

Common during spring and summer and presumably breeds on the Peninsula; a slight increase during the last few days of August and the first few of September.

BLACK-EARED WHEATEAR (*Saxicola albicollis*).

One on May 29th and one on August 28th.

ISABELLINE WHEATEAR (*Saxicola isabellina*).

Common in May; I think it breeds on the Peninsula.

STONECHAT (*Pratincola rubicola*).

First seen on October 24th; a few to be seen throughout November; twice seen on Lemnos at the end of December.

BLACK REDSTART (*Ruticilla titys*).

First seen on November 11th in the "Gully Ravine"; a fine male on November 22nd, and several there throughout November; several about the cliff-side and the ravine throughout December; on Lemnos I saw a few on January 5th, 6th, and 9th.

REDBREAST (*Erithacus rubecula*).

First seen on December 1st; odd specimens during the first fortnight of December; two on December 9th, one of which sang.

[On October 12th one came on board a transport near Crete.]

Nightingale (*Daulias luscinia*).

One singing on May 8th, 9th, and 11th in a wood near Morto Bay (on the south side).

Sardinian Warbler (*Sylvia melanocephala*).

Very common throughout November; I was never in the part of the Peninsula during the summer where these were seen in November, but possibly they were permanent residents.

Blackcap (*Sylvia atricapilla*).

One on May 13th by the "Pink Farm."

[Dartfold Warbler (*Melizophilus undatus*).

Birds seen in May and the summer were possibly referable to this species.]

Willow-wren (*Phylloscopus trochilus*—presumably this species).

Several from October 18th to 23rd.

[Bonelli's Warbler (*Phylloscopus bonellii*).

A bird singing on May 10th, which I think was of this species; I had heard them sing in Egypt a fortnight before.]

Chiffchaff (*Phylloscopus collybita*).

Possibly one on May 13th; one in the Gully Ravine on November 25th and December 15th; one on Lemnos on January 8th.

Olivaceous Warbler (*Hypolais pallida*).

One singing on May 11th; I had heard great numbers of this bird in song just before leaving Cairo.

Rufous Warbler (*Aedon galactodes*).

One early in May near Sedd-el-Bahr and one on June 1st in the Krithia Nullah; these seemed to be rather darker rufous than those seen commonly in Egypt during April.

Grey-backed Warbler (*Aedon familiaris*).

A grey-backed "Rufous Warbler" seen on August 20th on the high ground not far from Cape Helles was evidently of this species.

Hedge-Sparrow (*Accentor modularis*).

First seen on December 3rd, when twenty or more were about the scrub and bushes of holly-oak near the Gully Ravine; many seen daily until December 6th. These birds were so clean and bright that at first I took them to be of some other species of Accentor. They were as tame as those in England, and allowed

me to approach within a few feet. I saw no other species of Accentor.

Great Titmouse (*Parus major*).

Seen in June and August, when they were not uncommon in the trees on the French side; three or four on December 6th in a fir on the north-west side. One on Imbros on July 9th.

Sombre Titmouse (*Parus lugubris*).

I got an excellent view of three on May 29th in the centre of the Peninsula. They were very tame birds and I saw both male and female well.

Blue Titmouse (*Parus cæruleus*).

One on December 8th on a tree on the cliff-side.

Wren (*Troglodytes parvulus*).

I saw none until November 24th, when there was one in some scrub by the Gully Ravine; I saw odd birds several times during the first fortnight of December in different parts of the Ravine.

White Wagtail (*Motacilla alba*).

First seen on August 11th—four birds in the Krithia Nullah. On October 16th there were many hundreds all over the Peninsula, but by November 8th there were comparatively few; there were always a fair number to be seen throughout November and December, although on November 30th (during the cold weather) only about six were seen during a walk from one end of our part of the Peninsula to the other; they increased in numbers again a few days later.

Not uncommon on Lemnos at the end of December and in January—sometimes as many as twenty together.

Grey Wagtail (*Motacilla melanope*).

On November 11th there were two in the Gully Ravine, and several were always to be seen there in November and December.

Yellow Wagtail (*Motacilla flava* ? and others).

A small flock on August 19th; common by August 22nd and in large numbers from then until I left the Peninsula on September 5th. Several species were evidently represented; some had white eye-stripes, others pale saffron, and many had yellow eye-stripes; they varied greatly in the amount of yellow in their plumage and in the colour of the head. Most of them were, I think, young birds.

Meadow Pipit (*Anthus pratensis*).

Evidently a common nesting species; in large numbers also in November and December. Fairly common on Lemnos in January.

Red-throated Pipit (*Anthus cervinus*).

I saw a number of Pipits which were almost certainly of this species during October and November; I became quite familiar with this bird in Egypt, especially during the spring of 1915, and am fairly confident that I identified these correctly.

[Tawny Pipit (*Anthus campestris*).

On August 17th I saw a bird that I took to be of this species, which I saw commonly in Egypt in the spring.]

I saw several other species of Pipits, almost certainly including the Rock Pipit, but was never able to examine them sufficiently closely.

Lesser Grey Shrike (*Lanius minor*).

First seen on May 12th; a great increase on the following day and May 14th; none to be seen in June. I think a few bred on the Peninsula, as I saw a few during July and August, and I believe that a number of young Shrikes seen in the centre in July and at the beginning of August were of this species.

There was an increase on August 21st.

Red-backed Shrike (*Lanius collurio*).

First seen on May 10th; increase on May 13th and 14th, but I saw none after that date. They possibly may breed on the Peninsula in normal times, for I saw them on Imbros on July 9th and 11th.

Woodchat Shrike (*Lanius auriculatus*).

I saw one on the Peninsula in the middle of May and a couple together on several occasions during June and July. I also saw it on Imbros on July 9th and 11th.

Masked Shrike (*Lanius nubicus*).

Two on June 23rd and one a short time before; this species was to be seen in July and in August, and was not uncommon near the water-towers on the French side.

Spotted Flycatcher (*Muscicapa grisola*).

Several on May 20th in the centre—the only ones seen. On September 16th I saw one on a hospital ship in Mudros Harbour, Lemnos.

SWALLOW (*Hirundo rustica*).

Common during the second week of May; passing north on May 18th; few seen during the summer; a fair number passing north on July 18th; an increase on August 20th and many on August 21st.

A few passed a boat anchored off Cape Helles, between September 5th and 12th.

HOUSE-MARTIN (*Chelidon urbica*).

Passing north on May 17th and 19th; one on June 6th. Many at Kastri on Imbros, in July.

SAND-MARTIN (*Cotile riparia*).

From May 16th to 19th a few passed—several score on the 17th; one going north on July 18th.

GOLDFINCH (*Carduelis elegans*).

Common on the Peninsula all the time; especially common in November and December; many passed up the coast on December 1st, after the cold weather, and a flock flew north-east on December 2nd.

Common on Imbros, particularly on the more cultivated parts in the north. Several on Lemnos on December 31st and January 8th.

GREENFINCH (*Ligurinus chloris*).

Odd birds, on June 6th, in the Krithia Nullah, and July 18th, near Morto Bay—probably not uncommon on that side.

HOUSE SPARROW (*Passer domesticus*).

Common; roosted in the Gully Ravine in the winter. Not very common on Imbros in July.

SPANISH SPARROW (*Passer hispaniolensis*).

Two in the Krithia Nullah on May 13th; a good many roosted in the Gully Ravine, where I saw them in August, October and November.

CHAFFINCH (*Fringilla cœlebs*).

I first saw them on November 30th, though I was told that several had been seen for a week or so earlier than that. I saw several during the first week of December. On Lemnos on January 6th, 8th, and 9th, I saw a number of small flocks.

LINNET (*Linota cannabina*).

Fairly common in May. Not very common on Imbros in July.

Black-headed Bunting (*Emberiza melanocephala*).

Abundant on the Peninsula during May. One on Imbros on July 9th.

[Cirl Bunting (*Emberiza cirlus*).

On July 9th, on Imbros, I got a rather poor view of a bird which was almost certainly of this species.]

Skylark (*Alauda arvensis*).

Several small flocks on November 28th; hundreds on November 30th, on December 1st, after the cold weather, they were passing up the coast all morning. Common on the ploughland on Lemnos; I saw large numbers there on January 2nd.

Woodlark (*Alauda arborea*).

Seen along the top of the cliff; three on December 3rd, one on the 5th, and four on the 7th.

Crested Lark (*Corydus cristatus*).

The commonest bird on the Peninsula; nested in numbers. I saw a young bird with its parents on May 21st, and on May 25th saw a pair building. Very common on Lemnos and Imbros. They were distinctly tame birds, very much tamer than the migrant Skylarks. They seemed to be remarkably little disturbed by shells; if one burst in the grass or heather where they were, it merely caused them to fly up and utter their call-note, and they soon dropped down again.

Short-toed Lark (*Calandrella brachydactyla*).

With the exception of a bird seen on June 5th, which I think was of this species, I saw none till August 17th; there were large numbers on August 19th on passage along the upland above the cliff. Those I saw were of the ruddy-brown type.

(A small flock I saw on January 2nd on Lemnos were, I think, of this species.)

Starling (*Sturnus vulgaris*).

Small flocks on May 21st and 24th. Several flocks on October 27th; many scores on November 29th along the cliff-top; on November 30th, when the frost was very keen, there were hundreds everywhere on the Peninsula. On December 1st, on the break-up of the frost, many passed up the coast all morning. From December 22nd to 24th there were very many, and I saw one large flock of some thousands going north.

MAGPIE (*Pica rustica*).

Fairly common on the Peninsula; possibly not quite so common in the winter.

JACKDAW (*Corvus monedula*).

Many still about the ruined fort of Sedd-el-Bahr on May 7th; a flock often about the centre of the Peninsula. On Imbros on July 10th, and very common on Lemnos in flocks with Rooks and Hooded Crows.

HOODED CROW (*Corvus cornix*).

Common on the Peninsula, Lemnos, and Imbros.

In small flocks of about thirty together on Lemnos in January, and also in a flock with Rooks and Jackdaws.

RAVEN (*Corvus corax*).

Two to be seen throughout the year along the north-west coast, most frequently very early in the morning. Seen on Imbros in July. On Lemnos they were remarkably plentiful in December and January, and I saw between fifteen and twenty flying together; often they walked about in the fields near the troops, and allowed as near approach as do Rooks at home.

ROOK (*Corvus frugilegus*).

Two flocks flew across the Peninsula on December 4th, flying north. Fairly common in flocks with Jackdaws on January 6th and 9th on Lemnos.

SWIFT (*Cypselus apus*).

One in the middle of May and one on July 25th.

NIGHTJAR (*Caprimulgus europæus*).

Seen and heard during May, June, and July on the upland between "Lancashire Landing" and "X Beach." Several about the Gully Ravine at the end of August.

GREEK PIED WOODPECKER (*Dendrocopus lilfordi*).

Fairly common, especially near the water-towers on the French side throughout the year. I think, judging from the distribution of the two species as given by Dresser, that all I saw were *lilfordi*, and none *leuconotus*.

ROLLER (*Coracias garrulus*).

Common from May to August, especially on the French side and in the centre; evidently bred.

BEE-EATER (*Merops apiaster*).

On July 30th I saw six on the French side near the "Brown

House," and they were not uncommon near the water-towers at the beginning of August (including young birds). Some were passing on August 10th.

Hoopoe (*Upupa epops*).

On August 10th, two or three near the "Pink Farm"; on August 20th, three on the upland near "X Beach."

Great Spotted Cuckoo (*Coccystes glandarius*).

I saw several frequently in the fields west of "Clapham Junction" during June and on July 5th. All I saw closely were young birds, and had presumably been bred there.

[Tawny Owl (*Strix stridula*).

I heard what was almost certainly this owl hooting on May 11th and 28th.]

Little Owl (*Athene noctua*).

Not uncommon throughout the year. I saw them on the cliff at Cape Helles, in the centre, and in various places in the Gully Ravine.

Griffon Vulture (*Gyps fulvus*).

One on May 7th, flapping about the cliff at "V Beach," Sedd-el-Bahr, where there had been many casualties at the landing twelve days before. Twice in June I saw odd birds fly over the trenches on the right of the Krithia Nullah; and on October 16th I saw six flying over the Turkish lines west of Krithia.

Marsh-harrier (*Circus æruginosus*).

One on December 2nd along the cliff-top.

Pallid Harrier (*Circus swainsoni*).

A lovely bird flew over the cliff and out to sea on December 5th, carrying something in its talons.

Desert Buzzard (*Buteo desertorum*).

On August 3rd I got an excellent view of what was evidently an adult male of this species at rest near Cape Helles; it was exactly similar to a specimen in the Dresser Collection. On Lemnos, in January, I several times saw Buzzards which I think were of this species.

Several times in November I saw Buzzards that may have been this or Common Buzzards on the Peninsula, but could never get a view from really close quarters.

LONG-LEGGED BUZZARD (*Buteo ferox*).

On May 14th one flew over Krithia; on July 11th I saw one on Imbros. I got to know this bird in Egypt.

ROUGH-LEGGED BUZZARD (*Archibuteo lagopus*).

Almost daily in November several beat up and down the high land on either side of the Gully Ravine; I saw a fine male from above on December 1st, as it flew along the cliff-side, and there were several others about.

[SPARROW-HAWK (*Accipiter nisus*).

I think birds I saw in July and December, and on Lemnos in January, were undoubtedly of this species.]

HOBBY (*Falco subbuteo*).

Two frequently seen in June, July, and August; they were usually to be seen about some tall trees which sheltered a quartermaster's stores near the Krithia Nullah.

ELEANORA'S FALCON (*Falco eleanoræ*).

One on August 8th, over the Krithia Nullah, near the Hobbies' trees.

KESTREL (*Falco tinnunculus*).

Very common throughout the year. Seen on Lemnos.

LESSER KESTREL (*Falco cenchris*).

Common on the Peninsula in summer. I got an excellent view of the male on Imbros on July 9th and 11th.

CORMORANT (*Phalacrocorax carbo*).

Twice seen flying over the Gully Ravine in August and November. Several in Mudros Harbour, Lemnos, in September, December, and January.

SQUACCO HERON (*Ardea ralloides*).

On May 19th I saw one in a little marsh on the west of the Krithia Nullah, and again on the next day, when I twice saw it perched in a tree; troops were all round the few acres of marsh it was in, and shells fell there not infrequently, and I did not see it again. I became familiar with this bird near Cairo, where I saw numbers in April.

WHITE STORK (*Ciconia alba*).

A flock of twenty-five or thirty on May 12th and 13th; Mr. J. L. Bonhote tells me that on May 13th he saw many thousands passing slowly north, near Suez, a few of which settled and went on early next day. On May 17th a flock of forty-eight passed

north. Large flocks passed south during the second half of October; I saw the greatest numbers at dusk on several occasions.

Grey Goose (*Anser* sp. ?)

On November 29th, during the cold weather, twenty-one flew low across the Peninsula, going north; they varied in the extent of black on the breast, some being black and others quite white. I think some were Grey-lags; some probably White-fronteds.

Sheldrake (*Tadorna cornuta*).

Two flew down the coast on December 2nd, going south-west. I saw two on a lagoon at Imbros on July 10th, and one in the harbour at Lemnos on January 5th.

[Wigeon (*Mareca penelope*).

Eighteen to twenty duck, which looked like Wigeon, flew down the coast during the blizzard on November 28th.]

Red-breasted Merganser (*Mergus serrator*).

One seen in Mudros Harbour, Lemnos, on January 5th and January 10th.

Rock-Dove (*Columba livia*).

On August 3rd I saw one on the French side near the "Brown House." Several in July about a big clump of rocks on Imbros, some four miles from the coast; possibly feral domestic Pigeons, but they were some distance from any dwelling.

Stock-Dove (*Columba œnas*).

One flew north-east, along the cliff-top on November 30th, during the cold weather.

Turtle Dove (*Turtur communis*).

Common throughout the summer from May; one of the commonest birds on the Peninsula.

Chukar Partridge (*Caccabis chucar*).

I saw a small covey of eight on Lemnos in January, and heard that they were at one time quite common there; fifteen which I saw on the cliff-side on the Peninsula in November were almost certainly of this species. This covey, I was told, was to be seen between "Gully Beach" and "Gurkha Bluff" throughout the summer.

Quail (*Coturnix communis*).

A single bird on the cliff-top on November 30th, in the cold weather.

[On June 5th and 7th a large game-bird flew over the trenches; I cannot make any suggestion as to its identity.]

CRANE (*Grus* sp. ?).

Two on May 17th, with a flock of Storks, but they were too far away for it to be possible to determine the species.

STONE CURLEW (*Œdicnemus scolopax*).

I heard them each evening during May, and saw them on a weedy, stony upland near "X Beach," where they probably were accustomed to breed. On June 21st I saw one in the fields near the "Pink Farm."

GREY PLOVER (*Squatarola helvetica*).

Two on the mud by Mudros Harbour, Lemnos, on January 3rd.

KENTISH PLOVER (*Ægialitis cantiana*).

I saw a flock on the mud-flat, Lemnos, from January 3rd to 12th; twenty was the greatest number seen.

[LITTLE RINGED PLOVER (*Ægialitis curonica*).

I believe that three I saw on July 10th, on the sand beside a lagoon on Imbros, were of this species; one was a young bird.]

COMMON SNIPE (*Gallinago cœlestis*).

One on Lemnos on January 9th. I heard of others, and also of Woodcock, on the Peninsula, but saw none there myself.

DUNLIN (*Tringa alpina*).

Three on the mud-flat, Lemnos, on January 3rd, and two or three there till January 12th.

LITTLE STINT (*Tringa minuta*).

Two Stints on the Lemnos mud-flat on January 6th were probably of this species, which I had seen fairly commonly in Egypt.

REDSHANK (*Totanus calidris*).

One on the Lemnos mud-flat on January 6th.

COMMON SANDPIPER (*Totanus hypoleucus*).

One on August 26th, on the edge of the sea at Gully Beach.

TERN (*Sterna* sp. ?).

Either Common or Arctic Terns were seen several times during the cold weather, always passing up the coast in a

north-east direction. First seen on November 27th; several on November 30th and December 1st.

Black-headed Gull (*Larus ridibundus*).

First seen on December 2nd, when three or four flew up the coast in a north-east direction; there were scores in Mudros Harbour in January. During the previous winter I noticed them first on the Nile, at Cairo, about mid-December; on January 17th, 1916, Alexandria Harbour was full of them.

Yellow-legged Herring Gull (*Larus cachinnans*).

A few to be seen off Cape Helles throughout the year; many at Imbros, where I saw a flock of fifty on a lagoon on July 10th; a few in Mudros Harbour, Lemnos, in January.

Lesser Black-backed Gull (*Larus fuscus*).

Odd birds off Cape Helles, September 5th to 12th; a few at Lemnos in January.

Levantine Shearwater (*Puffinus yelkouanus*).

In flocks round Cape Helles—the first birds noticed on arrival and always to be seen afterwards; invariably in flocks, sometimes of a fair size.

Mediterranean Shearwater (*Puffinus kuhli*).

One seen off Cape Helles between September 5th and 12th. I saw it commonly in the Mediterranean.

Eared or Black-necked Grebe (*Podicipes nigricollis*).

Two in Mudros Harbour, Lemnos, on January 6th; I saw them well, and noticed the slightly upcurved bill.

THE MAMMALS OF FLANDERS.

By Captain Philip Gosse, R.A.M.C.

Much has been written and published about the birds seen in the fighting area of Flanders since trench warfare began; but little, if anything, about the mammals, except for occasional references to the plague of Rats in the trenches.

Coming out to Flanders last August with a field ambulance, I found much time on my hands, as the medical work naturally depends largely on the amount of fighting that is going on.

So, with the help of a dozen traps and some skinning appliances, I spent most of my spare time collecting small mammals.

The country, which seems to abound with small animals, particularly Shrews, is low-lying, level, highly-cultivated land, intersected with ditches, many of them having water in them the whole year round, to judge by the rushes and water-weeds.

There are no woods nor coppices, and most of the trees are pollarded willows, many of them hollow.

As far as I know the only two small mammals, besides Bats, of which I was unable to procure specimens, are the Garden Dormouse, *Eliomys quercinus*, and Water-Vole, *Arvicola amphibius*. The former is common in the orchards and gardens, according to the inhabitants, and the latter I have often seen in the river Lys.

On one occasion, a friend tells me, a German shell hit a hollow pear-tree in an orchard, and several *Eliomys quercinus* were picked up afterwards, having evidently been hibernating in the hollow tree.

Lt.-Col. Tweedie also describes how he found one asleep in the thatch of a shed, which woke up sufficiently to bite his finger, and then went to sleep again.

The kind of trap used was mostly the all-wire back-breaking type recommended by the Natural History Museum authorities.

For bait I found ration cheese by far the best. With this one could catch all the five different Shrews, Wood-Mice, and an occasinal Bank-Vole.

The solitary specimen of the Subterranean Vole (*Pitymys subterraneus*) which was procured was also caught with cheese.

For the Voles I tried almonds, raisins, chestnuts, bread, and apple, of which almonds proved the most attractive, but even the Voles seemed to prefer cheese.

Once I caught a Common Shrew (*Sorex araneus*) with bread, and on another occasion a *Crocidura leucodon* was trapped after eating more than half an almond—a surprising diet for one of the Insectivora: but at the time the ground was frozen hard and there was a good deal of snow.

The Moles were caught with the ordinary mole-trap, and are very common.

Hares were fairly plentiful, but I did not see a single Rabbit during all the months in which we were in this part of the country.

The inhabitants told me that there were Hedgehogs in the summer, and a schoolmaster with whom I went to fish one day in some old clay-pits declared he had several times seen an Otter there.

List of Mammals Caught Close to the Trenches in Flanders from October, 1915, to February, 1916.

Talpa europœa. Mole.

Very common.

Sorex araneus. Common Shrew.

Very common.

Sorex minutus. Pigmy Shrew.

This, the smallest of all European mammals, some specimens measuring from the tip of snout to end of body not more than 40 mm., was fairly frequently caught in hollow willow-trees and in water-ditches. Always caught with cheese for bait.

Neomys fodiens. Water Shrew.

They are fairly plentiful in certain water-ditches, though they seem to be extremely local, and are fond of large deep ditches with plenty of water in them and sufficient cover, such as long grass and brambles.

They live in holes in the bank, with a kind of platform of mud or earth sloping down to the water's edge, and can generally be caught by placing the trap on this platform.

Some of the specimens I got were of a beautiful black colour all over; others had a warm chestnut-brown patch on the breast in the middle line; while a few had white ear-tufts and a white median line down the belly and extending along the underside of the tail.

Crocidura leucodon.

This very handsome and rare Shrew proved to be comparatively plentiful. They were caught in hollow willow-trees and in banks, but not on flat ground as *Sorex araneus* often is.

Cheese was the only bait that attracted them, except in the case of one that had eaten half an almond by the time the trap went off.

This is a fine Shrew in its winter pelage, and differs from *S. araneus*, amongst other points, in having long hairs (5 mm.) in the tail as well as the close short hairs.

Also it has a definite line of demarcation between the colour of the fur of the upper parts and the belly.

The colour of the upper parts varies from slaty drab to dull russet, while the under parts and inner surface of the limbs are buffy white.

Also the dorsal surfaces of the feet are almost white. The skull and teeth, too, differ in many points.

The ears, though small, stand out conspicuously above the fur, and have two well-developed valves.

Geographical distribution: Central Europe from Belgium to Hungary; south to Italy; not known from the Iberian peninsula.

Crocidura russula. The Garden Shrew.

Very common in gardens and close to farm-buildings.

It differs from *C. leucodon*, amongst other things, in not having a white belly nor a line of demarcation on the sides. One specimen was caught in the fire-trench.

Mustela nivalis. Weasel.

The only specimen I procured was killed during the threshing of a corn-rick.

Evotomys glareolus. Bank-Vole.

These are far from common, possibly owing to the flatness of the country and the amount of standing water. Caught with nuts and with cheese.

Pitymys subterraneus. Subterranean Vole.

Only one specimen procured.

This Vole burrows to a depth of four and five feet, and is therefore difficult to trap.

Apodemus sylvaticus. Wood-Mouse.

Very common; so common, in fact, that in some places I had to catch most of the Wood-Mice before I was able to catch anything else.

Most of them have pure white bellies, but a few have a yellowish median line.

Micromys minutus. Harvest Mouse.

One was caught in the same rick as the Weasel, about a mile behind the trenches.

Epimys rattus. Black Rat.

The Black Rat seems to be pretty common in the farm-buildings, living in company with the Brown Rat. I have no evidence that it has been found in the trenches.

Epimys norvegicus. Brown Rat.

A pest everywhere from the trenches backwards, although possibly it has proved useful as a scavenger.

Mus musculus. House Mouse.

I cannot conclude without tendering my great thanks to Mr. Oldfield Thomas, F.R.S., of the British Museum, for all his help and encouragement to a beginner in the study of small mammals.

A DIARY OF ORNITHOLOGICAL OBSERVATION MADE IN ICELAND DURING JUNE AND JULY, 1912.

By Edmund Selous.

(Continued from p. 68.)

June 30th.—After a little while he came down from the turves, walked a little, still "wittying," then, all at once, became both silent and invisible. It was not till close on 8 p.m. that I saw him again, and at once, became interested, for he was drawing towards the nest, in a stealthy manner, and quite silently. When still at a little distance, he rose and flew over it, alighting about as far off on the other side. A moment or two afterwards, the sitting bird rose, and, flying over her mate, came down a good deal farther away. Not being able to turn the glasses on both birds at once, and fearful of losing the male in his expected approach, I covered the now empty nest with them, and very soon saw a bird creep quietly up, and take its place, upon it. As soon as this was a *fait accompli*, I redirected the glasses to where the previously sitting bird had gone down, when they instantly picked her up again, standing in the same place, and preening herself. The change was accomplished a minute or two after 8. Now I come to think of it, it is, most probably, the male that has been sitting, and the female who has now taken her place on the nest for the night, unless, indeed, there should be a later change, but this is not so probable. In any case, both sexes incubate. Assuming that I have differentiated them (this last time) correctly, the approach of the female to the nest, with the way in which she sunk down upon it, was much more stealthy than that of the male, who also sat higher than his partner is now doing.

On leaving, I walked towards the nest, to see if this bird, too, would fly off it, like the other, or creep away stealthily along the ground; but she also flew, though not before I had got much nearer. I then walked to another Whimbrel's nest—found that

day—in which there are but three eggs, leaving another to be laid—the one I have been occupied with has four. When I was yet so far off that I should have thought there was no need for alarm, a bird that I have no doubt was the layer of the eggs began flying about and "witty-wittying" in the most plaintive manner. There was no bird on the nest when I came up to it, and none flew off. No fourth egg had been laid, though I had been out of this bird's way for four or five hours. Before this, however, I had waited for it to go to the nest, which, after some two or three hours, it did do.

On each side of the nest, to mark it, I had made a mound of turves, and, just between these, the bird sank down—at least it disappeared, and that, I suppose, was how it did. It would seem, therefore, that one bird or both—more probably, perhaps, the female alone—covers the eggs for some time before the full number has been laid, and does not repair to the nest only to lay.

I also watched a Golden Plover's nest, at a distance which I should have thought was sufficient, to allow of its being approached by the bird, but it never was, so far as I could ascertain. I remarked, however, that there was always a bird close about me, that seemed to watch me, and uttered, ever and anon, a plaintive "peeng." In the light of my previous experience, I took this to be the male.

July 1*st*.—Started, this morning, up the course of the stream, to see something more of the Eagles, but it only ended in a horrible experience with Mosquitoes, or Flies for those who prefer to call them so—but such Flies! They swarmed now along the banks, which, low and flat where the homestead stands, got higher, as we advanced, till they became, at last, rocky precipices, between which the river, here much compressed, rushed in an impetuous, foaming torrent, making, with the wide-watered shores of the great gloomy lake from which it leapt, almost suddenly, out, as fine a scene, perhaps, as I had looked upon since leaving the Zambesi and its Falls—the sea alone, and always, excepted. At the head of the gorge, where lake and river merge, we dismounted, and, having unloaded the ponies, began to get the things into the boat, and it was here, and whilst doing this, that the plague reached its climax, making a state of

things worse than any picture I had formed in my mind, though not unprepared—this being, according to Sigurdsson, the worst place in all Iceland for Mosquitoes—*he* never called them Flies. Be they what they may, the air was darkened about us as they descended in great clouds, and with a rushing sound, upon ourselves and the horses. The latter seemed no longer to have hair upon them—a horrid sight—and Sigurdsson's coat, as he knelt over the luggage, was entirely hidden by a vast crawling mass. I was the same where I could see myself, and everything, as it was taken off the horses—the saddles, especially, being hot from them—was swarmed upon in the same way. As they were disturbed by the packing or transportal of anything, they went up, and then swarmed down again, in great rushes which, for a few moments, partially obscured the sun, then shining brightly. It was as though a fine mezzotint veil had been flung over it, one which moved and glanced, and varied in its density, the effect being very novel and striking, though the discomfort and disagreeable ideas which these hosts excited, as well as the faint, sickly smell—at moments less faint, and more sickly—which emanated from their myriad bodies, prevented one from admiring. We humans had, of course, our mosquito-nets, but the horses, without any protection, kept coughing and choking till we got them into the corrugated iron shed which stands here, for this and other purposes connected with making a halt. We then made haste to get into the boat, and cross, but could not prevent a great multitude from embarking and making the voyage with us, for they did not fly, not liking the water, it seems, but settled upon oars, rowlocks, gunwale, etc., as well as on ourselves and our belongings. How many we shipped I don't know, and, as nothing seems too high an estimate for the "numbers numberless" that we left behind, I had better refrain from making one—but they did "darken the sun."

I did something, whilst Sigurdsson rowed, to lessen the number of these passengers, but they revenged themselves, unpleasantly, in smell and juice, and, before long, baling the boat became a more pressing consideration. At length we got across, not that it took very long, but time is a matter of sensation. Since I understood that Mosquitoes on the other side were not so numerous, it did not occur to me to feel anxious about

being left with them. They were not *so* numerous, indeed, but that was all. Where we landed—and difficult enough it was to get the deep-keeled, small boat, that kept filling with water, in amongst the angular, unaccommodating rocks and stones, quite different from sea-rocks—was only a little beyond the eyrie, which is in the face of the line of low cliffs that crowns the steep shores of the lake, and, before we were out, the birds had sailed up, but with so calm, unimpassioned a demeanour as gave me small hopes concerning them. However, we got up the tent and, for three or four hours, kept quiet within it, the Mosquitoes, all the while, swarming in at the doorway, which, to observe, we had to keep open, to an extent which, however minor to what it was on the opposite side, soon made them, and not the birds, the principal objects of interest, and would have done, even though there had been young in the nest, and the parents constantly feeding them. But though we heard the Eagles more than once, they never came to the ledge, and by 6 o'clock I felt pretty sure that there would be nothing to see if I stayed, and, also, that to stay, under such circumstances, would be almost impossible—unhappily for me it was not quite. So the tent was taken down and the boat loaded up again, but what with the annoyance at having to give up seeing what I had so much hoped to see, and the fear of being possibly mistaken in my conclusion, aided by a temporary lull, for some reason, in the exasperating plague, which made me think it might be better, altogether, on the beach, the upshot was that my yearning wishes got the better of my reasoning powers, and I decided, at the last moment, to stay—at first till the following morning, and then, as the Gods made me madder, and madder, till the morning after that.

So up the tent was put again, on the actual shingle, just a step or two beyond the water, but, almost before the boat was out of sight, it became apparent that my hopes, in regard to the Mosquitoes, were fallacious, and after an effort of endurance, which was unfortunately too long, I came to the now fixed conclusion that to stay, under such conditions, was madness, and to get back the only sane thing to do. There might, I thought, be just time to reach the point opposite to where Sigurdsson would now have landed, before he started back with the ponies,

but, when I got to the heights above it, the shed, which, unsightly as it was, had before been a refuge, and looked like one, stood now all lonely and comfortless, and I saw that he was gone. I was, by this time, surrounded by a vast halo of Mosquitoes, from which, though my face was netted and my hands gloved, I could not adequately guard my wrists, on which I was bitten over and over again. I carried an umbrella, which, for Mosquitoes in moderation, is a very good thing, for comparatively few come under it, and those that do fly up into its dome, and there settle. So they did now, with a sound like that of hail coming down on it, but their numbers made this a loathsome sight, and their smell, as a consequence of these numbers, was very disagreeable. Also holding it up exposed the wrist, yet I could not prevail on myself to put it down and let the hosts close in on me in all their density. It is not a mere matter of getting bitten or not (though the bites "took" with me badly) but there is something in the very presence of these venomous, whirling swarms, taking the place of all nature, about one, as it were—for they absolutely stop all enjoyment of sight or sound, nay almost the very sense of either, except in relation to their disgusting selves—that acts like a panic, bringing a sort of confusion on the mind, and, with it, a frantic desire to get away, and have relief from this horror. It was with such an almost desperate feeling of necessity that I had been driven from the tent, as though to stay were impossible, and now, under a still more urgent degree of compulsion, I was flying back to it again, as to my only refuge for the next forty hours or so. As I sighted it again from the line of black volcanic precipices that frowned above it, and began to pick my harassed steps down the one descendible gulley amongst them, my feelings were gloomy as their frown. I reached it, and all thought of Eagles or any bird in the world vanished for those forty hours of "damnèd minutes" which I had to pass inside it. I pulled the claps tightly together, and fastened them, drew down the window-blinds, and the task now was, by successive killings of those which clustered on the canvas and made the vast majority, to keep the attacking aerial bands from increasing; and this I was just about able to do, but more and more at the expense of my wrists, especially the right one, which began to look curious,

with an occasional face-bite inside the net, for, from time to time, one or more would contrive to get through it, filling me with apprehensions lest this should become more frequent. Night—for there is night here, though its gloom can be seen—brought some cessation of hostilities, and I was able to sleep, with the net on and with an oilskin coat over my face. Otherwise I should have got no sleep at all, as I never could take off the net, except once, for about three minutes. But oh! the length of the next day! Fine every hour—there is a fine spell on now—but "fair is foul" with Mosquitoes.* To go out was impossible without going into more of them and letting more of them in. I got some relief by tying one of my plaids across the tent, from window to window, and pulling it, in a penthouse, over my head, letting it fall behind me, so that, to go down it, they would be leaving light for darkness, which Mosquitoes (creatures opposite to humanity) don't do. A light-proof tent, therefore, ought to make one immune from them. The sun—it was not only fine, but broiling—streamed all through mine, its violent green being possibly an added attraction to the hosts. To sit or lie like this, in thick clothes, under a plaid that I could only just peep out of, and in which I had to keep my hands muffled—and, even with all this, some got down my tall Swedish boots, and so at my legs—was only a few degrees short of suffocation, but, not being quite that, was better than Mosquitoes.

The lessened activity during the next night was a little more marked, I thought, and it was then that I took off my net for that short space, as mentioned, which enabled me to eat a mouthful or two of cold pancake† and drink a little water, but at 8 o'clock next morning signs of a state of things yet more abominable than the day before began to penetrate even through the piles that I slept under, and, sitting up, I found myself in

* This is quite true. They cannot do so much on a cold rainy day, which I used consequently to long for. Fine ones, on the contrary, I would have abolished altogether for the time being, had I possessed such a power. However, from the close of the episode in question, I might just as well have had it.

† Pancakes are a staple dish in Iceland, but with that unfortunate qualification. When I mentioned that we ate them hot in England, this roused curiosity only, not enthusiasm!

the centre of what seemed a Mosquito-hive. The sunnier side of the tenting they almost hid, "making the green—one *black*," columns were pouring in through the jointures of the closed windows and where the walls of the tent met the ground, whilst the air was full of them and of the small detonations which they made as they hit the top or sides, both from within and without. The heat, too, was now almost unendurable even for the few hours more of it only which I expected. However things had got to the worst, and they shortly mended. First I took a plaid, and exterminated the greater number of those that were settled on the sides and roof, by drawing it along them. I then heaped pebbles on the canvas in contact with the ground or that ought to be so, or otherwise tried to stop up the apertures, however small, all round the sides of the tent; but nothing was quite effectual, the stones least of all, for Mosquitoes still crawled up between them, and still the columns entered by the windows. To check these last, I went out, and threw one of my two plaids over the top of the tent, to hang down on each side, thus covering the windows, and then, in a series of horrible exits—for outside was all one great swarm—I added the other one and the tent flooring, as well as my oilskin gaberdine, thus covering it all up, except a small space, at one end, where the light still shone through. Here the invasion continued, but not, now, in great force, and, by keeping at the back of the now darkened tent, where it was darkest, the attacks, for the most part, ceased, and I sat in comparative comfort till about 11, when Sigurdsson rowed up. I might have thought of this expedient—a sufficiently simple one—at the very first, but, owing to inventive poverty or to its not being clear to me, from the beginning, that the light inside the tent was the attraction, or, at least, the conditioning circumstance, it did not enter my head, though I did hit upon a clumsy, uncomfortable and very inadequate substitute for it, inside instead of out. The lesson to be drawn is to have forethought and do things properly, for with a quite-darkened tent one might exclude Mosquitoes entirely, whilst a small lighted area in the front part of it, only, would allow of observation whilst sitting, oneself, in the dark, and, since the main incentive to entrance would then be absent, or, at any rate, unperceived, only a few would be likely to find their way in. The best plan of all, how-

ever, would be to arrange for the absence of Mosquitoes entirely, and this could be done in two ways, either by visiting only those parts of Iceland where they are not found, or by leaving about the middle of June. The official date for them (here at any rate) is the 24th of June, but, unlike the official spring in England, they begin sooner. The Black Flies come a little before them, and are bad enough, but nothing in comparison. They bother—very much—but don't bite, nor are they in such swarms. One may, I suppose, make oneself personally impregnable to both, but only by a great loss of ease and convenience —life is no longer the same—nor is it so easy as one might think. For myself, I was very defective in making arrangements, and only brought one net, without rings to fasten round the hat. That, however, is as they all use them here, and I think, in many ways, it is better than with the rings; one can use the glasses, for instance, and very well too, I find. But the problem is not the face but the hands, and, more still, the wrists, nor is it a completely soluble one, for one cannot do everything (nor anything comfortably) with gloves on, and if they are sewn to the sleeves, which is the one and only way to protect the wrists adequately, then they can never be taken off. Of course if Mosquito-bites—or these inferior Icelandic ones, as I am asked to consider them—don't affect one, then it doesn't matter, or not nearly so much, for nobody, even here, finds them pleasant. Apparently, they don't affect Icelanders—or not the peasantry—but they do me, and my right hand and wrist now is a spectacle, with my left but a few degrees better. There are some hundred and sixty bites on the wrist alone, that I can count, but the greater number of these are double or treble bites—or more—for Mosquitoes, according to Sigurdsson, love to fasten on the already bitten spot, and go on till they have "made a hole," nor (as I would add) do they stop then, if they can help it. To the fact I can certainly testify, but, for the reason of it, want of room would be an adequate one, in my own case, and, I should think, in most others; for, affected or not, nobody here plays the part of Simeon Stylites with Mosquitoes.

Thus wretchedly ended my attempt to study the domestic habits of these grand birds, amidst their native wildness and solitude. Either they had abandoned their eggs through fear

of me and the tent, in consequence of which the tenant of the healthy one perished, or both of them, instead of one only, as is commonly the case, were this year infertile. I have given my reasons for not regarding the second of these alternatives as excluded, to which I may here add the fact that, in the case of a pair of Nightjars which I watched, without (at that time) the birds having any suspicion of my presence, the eggs were once left uncovered for seven hours, yet, in due course, hatched out. What I most rely on, however, is the statement which was volunteered by the proprietor of the eyrie—who should be the most likely to know—that the eggs of this pair of Eagles were seldom good for two years in succession, for, as will shortly appear, they were good the following year—that is to say one of them was, if we assume that two were laid. The fact spoken to may seem a strange one, but it was spoken to, and the evidence has to be taken. There is also Sigurdsson's assertion that, in Iceland, Eagles are not shy, but always build in the neighbourhood of human habitations, and of this both the pair in question and another, afterwards to be mentioned, are examples. It makes no difference in the inferences that may legitimately be drawn from this, whether it is the habitations that have come to the Eagles or the Eagles to the habitations. The latter, for reasons sufficiently obvious, is, in fact, perfectly possible, but assuming the former to represent the facts, yet why have the birds, if shy, not left, on that account? That is not an easy question to answer; but, on the other hand, there are reasons why, in a country like Iceland, one might expect, even now, to find birds of all sorts less shy than in Europe generally. Sought or unsought, however, the proximity of human beings must react upon the disposition and habits of any animal, and the point here is what these Eagles now are, not how they became what they are. I myself was witness of the fact that the putting up of the tent which, with the general installing, took over an hour and involved the presence of four persons, as well as a boat, did not drive the sitting Eagle away, or even appear to make her anxious, and it is difficult to understand why, this being so, the tent itself, with moss stuck over it, and its one occupant—not more obtrusive, I think, when outside it, than the shepherding lads I have spoken of—should have had a more

disquieting effect. Finally, I was so much nearer to the Merlins whilst watching them, with the tent so much more exposed, that—since, according to Darwin, there is no real relation between shyness and size—it is rather a puzzle to say why my presence should have been so much better tolerated in the one case than the other.

For it must not be supposed that because the eggs of an Eagle here are more coveted than those of a Merlin, the latter are therefore let alone. Nothing is let alone. All is "obtained", when and wherever it is obtainable. No doubt the different kinds of property are taken with different degrees of eagerness, but, since taken they are, this should not affect the views and sensations of the various owners, so that one may well ask why a Merlin, in Iceland, should be more tolerant of humanity than a Sea Eagle; and, as a matter of fact, it is the smaller of these two tyrants that keeps farthest away from the grand one. It is violently moved, too, whenever the latter shows himself in the vicinity—even the not very near vicinity—of its nest. Yet the facts were as stated. The birds soon reconciled themselves to the presence of the tent, or, rather, they never seemed to care about it, close as it was, and once I was inside it, they thought no more about me. So great a difference, with the other facts I have adduced, does, I think, raise a legitimate doubt as to whether I was really the cause of the catastrophe. But I do not wish to shirk my responsibilities either. Very likely I was, and this will always be matter of keen regret to me. Let me now, however, speak of what I have done to make amends.

As before stated, before coming out to Iceland I had bought, or, rather, hired this Eagles' eyrie for observational purposes, and, before leaving, I did so again, prospectively, for the following year, on the understanding that the birds should be allowed to hatch their eggs and rear their young, without disturbance from anyone. Accordingly, in the spring of 1913, one, at least, of these potential eggs existed, and became an eaglet, which, having successfully accomplished the days of its nursery, was launched, in due course, upon the air. But this was not all, for I have been happily instrumental in helping, not only this one pair of birds, but every Eagle in Iceland, as well as all the individuals that there inhabit, of some twenty other species, from the first moment of their first birth (for a bird may be

said to be born twice), as the following letter which I received from a prominent naturalist of Iceland, whose name and indicia I think it better, for some reasons, not to give, will make clear. Perhaps, as I think I have some reason to congratulate myself on the contents, it would be better still not to give the letter, but it contains, with interesting details, what may still be information to many, and such praise as is accorded me, though I value it, is not of a kind that the world values. Since I have been blamed and—what is more—may have cause to blame myself, in the matter of these Eagles, it is natural and, I think, allowable for me to set forth the *per contra.*

REYKJAVIK.

2.2.14.

"DEAR SIR,

I am very grateful to you for the encouragement you have given to bird-protection in this country. The two articles of yours which were published in . . . were well received, and understood by many of the younger generation. We saw the danger of not protecting the eggs, and of the egg collector, a danger which had been entirely overlooked. Then it was that I, after the advice of our . . . wrote to your Society for Protection of Birds, but got no answer at that time. The letter must have been lost. Later, we got, through Mr. Eirikur Sigurdsson and your aid, valuable information from the Society. Our Parliament sat last summer, and we resolved to get the Bird-Protecting-Act sharpened, and a new one for egg-protecting. We got about four M.P.s, who were entirely convinced, on our side, but the majority had either no opinion or a backward and hostile one. . . .

But at last we got one Act for both, an Act which protects the eggs of about 20 birds, mostly sparrows (finches ?) and waders. Then the eagle was protected (and its eggs) as we could prove how near it was extinction. . . . I thought I had a copy of this Act at home, but, for the moment, I can't find it. But surely you shall get it very soon.

Now you certainly know that we are not very law-abiding people, and the great question is : How can the Act be protected from being violated ? We have thought about it, and found some hopeful points in the case. . . .

Very many of those societies have, as some of their objects, to protect birds and animals, and especially to do away with the habit of robbing nests. I hope to be able to have some strengthening influence. . . . Mr. E. Sigurdsson has lent me some of your publications on bird life in Iceland, and we hope to be able to translate and publish parts of them.

Next to those widespread societies are the teachers in Elementary Schools, both in willingness to work on such lines, and in their scope to influence the public. I am there rather fortunate also. . . . From many of them have I got direct promises to influence their pupils in this way.

I am sure you will be glad that your staying here, and the advices you have given us have, in a way, been understood and acted upon; you have started a movement here which, in due time, will entirely change and civilise our opinions towards birds and our wild nature in general. This will not be won all at once, as there are very strong antagonistic forces, but it will be won by and by.

Hoping that you may spend a pleasant summer again observing the birds, whose defender you have been, I remain,

etc."

I hope, then, that those who share my views, on these matters, will think that my going to Iceland has been productive of more good than ill.

July 3rd.—After leaving the Eagles, I rode a short distance with Sigurdsson to see the nest of a Great Northern Diver, but the chief objects of interest for me, in the series of small meres and islets which here make an outlying corner, as it were, of the great lake of Thingvalla, were the Red-necked Phalaropes that everywhere abounded upon them, for it is these birds now that I specially wish to study, though I fear I have left it too long. As we passed the first shallow reedy pool, which was isolated and quite small, I saw several of them rising from the water, and making little darts at one another, in a more pronounced way, I thought, than when I had last seen them acting so, or, at any rate, as pronounced, each time, as in the best former instances. I dismounted, and walked to a low rise of the ground, near by, which made, in itself, a good post for observa-

tion, but, as part of the program, the gathering had now taken flight, and since, after waiting a fair time, there was no return, we rode on to the island of the Divers, a quite small one lying only just off the shore, so that the horses were able to cross to it, though they had to wade deeply. In the pleasing little network of shallow pools and bays formed by the irregularities of its shores, many Phalaropes were swimming, and, standing so close to them that the glasses were seldom necessary, I made out the following: (1) It was the smaller and more plainly coloured male bird that most frequently rose from the water, and flew at the larger and handsomer female, and these flights were not only amorous, but satyrian in their character. Of this there were several examples, but the two most marked ones were: (*a*) Where the actual attempt on the part of the male was unmistakeable. (*b*) Where the resistance of the female, which, in the first instance, was of a general, though unmistakeable character, was, in addition to this, marked by a special action, in which the posterior part of the body was dipped, with a quick and strongly curved motion, below the surface of the water, away from the male. (2) These amorous attempts on the part of the male were not always confined to a single female. In one instance especially, two were made, in rapid succession, upon first one and then another of a pair that were not far apart. (3) One female would sometimes fly at another in a bellicose and threatening manner, which the threatened one would similarly assume. The hostile spirit was quite unmistakeable, but nothing that could be called a contest took place whilst I watched. (4) On one occasion a male flew at a female, not amorously, but with a little peck or attempt at one, for I think she just avoided it. Immediately after this, and, to judge by appearances, as a corollary to it, he flew to the shore—represented by my island—where he was very shortly followed by the same female. She alighted just by him, on which he flew to the water again. I then walked to the spot, which was hardly a dozen paces off, to find the female still there, and on her nest, which contained four eggs. This certainly looks like an admonition, given by the male of a mated pair, to the female to attend to her incubatory duties, and one which was followed by her. Since however the duty here is of a grateful kind—as indeed, amongst animals, all duties are—no

inference as to power or dominion possessed by the admonisher can rightly be drawn, unless it be the power of reminding. (5) Twice, at least, a female Phalarope on the water rose and flew at a male there, who, rising in consequence, and flying to a trivial distance, after the usual manner, returned her *démarche* by then flying at her—amorously, it appeared to me, but not nearly so wholeheartedly so as when taking the initiative. The action of the female seemed, in these instances, to be of a provocative kind, and so intended.

In the courting or, rather, amorous seeking of two females in succession, by the male Phalarope, as instanced by me, we seem to have an indication of polygamy in this species, and another may possibly be furnished by my finding a second nest very close to the one I have mentioned—within a step or two of it. It is the cock bird, generally, who drives trespassers from what he considers his home territory. His hostility, in such cases, would be directed, in its full strength, against intruding males, but there would be no such intrusion, were he the husband of two contiguously building females, or of any number of such. Certainly the females of these Red-necked Phalaropes seem to be much in excess of the males. For one plain bird, one sees several brightly-coloured. An excess of the hens of any species, whatever the reason, would encourage selection on the part of the males, and this again would foster rivalry, as between the females, with solicitous actions on their part. But can we always be sure that the larger and brighter-coloured bird is the female, and the smaller and plainer one the male? May there not be smaller and plainer specimens of the former, and larger and less plain of the latter? If so, it might be difficult to distinguish the sexes as between two such badly representative individuals. Of the various kinds of intersexual activity which I have here noted there is only one in which the act itself reveals the sex.

(To be continued.)

NOTES AND QUERIES.

GENERAL.

The Itineraries of John Ray the Naturalist.—It would be interesting if the present whereabouts of the originals of The Itineraries of John Ray, the famous Naturalist, could be ascertained. They commence in 1658, and terminate abruptly at the College of Eton in July, 1662. In 1760 George Scott, of Woolston Hall, in Essex, printed lengthy selections from them, and these were reprinted in 1846 by Dr. Edwin Lankester. Scott died in 1780—some years after William Derham, who was his uncle by marriage—and his library, etc., was sold in July, 1782. It is more than likely that at its dispersal, the manuscripts of the Itineraries were disposed of too.—J. H. Gurney, (Keswick Hall, Norfolk).

AVES.

Cuckoo Problems.—In the 'Zoologist' for 1915, p. 317, Mr. J. S. Elliott writes: "Occasionally the egg of the Cuckoo is the only egg found within the nest, but the probability is that the first egg of the foster-parent has already been removed." In the September number of the 'Zoologist' for 1915, p. 355, I stated that there are many instances to which the above remarks cannot apply, since many of the Cuckoos' eggs have been known to have been deposited in incomplete and even deserted nests; in confirmation of which, two friends write that they too have known Cuckoos to lay their eggs in nests before such nests have been finished. One adds that he has known a Meadow Pipit's nest from which three Cuckoos' eggs have been taken, all evidently laid by one individual.—E. P. Butterfield.

Various Bird Notes from Bradford District.—Mr. Ellison, of Steeton, near Keighley, writes me that he found two eggs of the Nightjar laid on the top of a low stone wall last season, which were hatched in this situation. I recorded an instance some years ago in the 'Zoologist' of a Nightjar laying its eggs on the top of a table in a keeper's hut on the top of Barden Moor in Wharfedale. I am glad to report that the Greater Spotted Woodpecker brought off its young last season in Bingley Wood, and two Turtle-Doves were seen by the gamekeepers in May, but it was not ascertained that they bred. Only one instance of the nesting of the Hawfinch in this

district was brought to my notice. A few Crossbills were still here, or near here, so late as the last week in February. I saw a Little Auk in February last which had flown against the telegraph wire and killed itself, and a Goldfinch was seen here by one of my sons. I am quite certain I saw Coues's Redpoll (*Cannabina exilipes*) feeding on the seeds of Spiræa in the wood near here in October. It was certainly not a Mealy Redpoll, its rump being much too purely white. It suffered me to approach within a very few feet before it flew away. This genus is passionately fond of the seeds of Spiræa. I have seen a good many Mealy Redpolls at very irregular periods about here, but their rumps are streaked, not white.—E. P. Butterfield (Wilsden).

Food of the Black-Headed Gull.—In the 'Zoologist' for 1907, p. 387, I recorded the behaviour of the Black-Headed Gulls on the moors in Upper Wharfedale, from which I inferred that they were trying to take the eggs of the Lapwing, although I had no direct testimony to this effect. Whenever the Gulls flew near the nests of the Lapwings, they were invariably driven off, much as I have seen Cuckoos driven when in the neighbourhood of the nests of Meadow Pipits, only to fly to a comparatively short distance, and, quickly returning, to be repulsed again. A few days ago I had a letter from a friend, who states that this species is "an *inveterate* (perhaps he is wrong here) egg-robber. I noted one last season take the eggs of the Lapwing, as well as those of the Redshank." I quite believe this Gull is changing its habits, and has been for some years.—E. P. Butterfield.

Abnormal Nesting of the Wren.—Referring to the 'Zoologist' of 1914, p. 433, and 1915, p. 35, I found two similar nests of the Wren last season near here, both built right inside stone bridges, in situations similar to such as are usually selected by Titmice, and without any roofs whatever; and was shown another built in a wall surrounding a reservoir near Bingley. I found "cock nests" within a few yards of the former two nests, but these were not used except for sleeping purposes at night. Perhaps such nests as those described above are not as scarce as one would suppose. The difficulty of finding them may to some extent account for their apparent scarcity. Amongst the curious traits in the economy of this species is the habit of occasionally appropriating the nests of other species—two of such appropriated nests I have met with, viz., that of a Whitethroat and that of a Garden-Warbler or a Blackcap.—E. P. Butterfield.

Observations on the Whimbrel (Numenius phæopus).—The habits of the Whimbrel differ rather considerably during the two periods that it is met with on the mud-flats of the East Coast. In the autumn, small and rather wary flocks of immature birds are mostly seen; but in the spring, when they are travelling north to the breeding-grounds, single birds and much smaller parties are frequently found about the "flats." At this latter season they are more easily approached. Thus, when I first came across the Whimbrel on a bright May morning, at low water, when the whole of the tidal broad of Breydon (Norfolk) was a vast expanse of mud, they were scattered about singly and in twos and threes as is their wont. As the flood-tide made, they got together more, and still later were met with in flocks of from twelve to twenty individuals. When the mud was beginning to cover up fast, the Whimbrel were among the first flight of waders to leave Breydon. They mounted high in the air, and when they had circled over their late feeding grounds once or twice, departed in an irregular flock for the marshes. Several hours later, when the tide ebbed, exactly the reverse happened, the birds coming back in flocks and then scattering themselves further afield in smaller parties. The Whimbrel moves about with a very sedate step, lifting its feet well as it walks. It is most graceful in all its movements, rarely presenting an ungainly appearance. The body is nicely balanced, and the head proudly poised on a neck that is constantly being lengthened and shortened. When the bird is feeding, the head is moved from side to side as it looks right and left. The mud is pecked very frequently, sometimes at every step, but sometimes only once in about six yards or so. I suppose this is according to the abundance of the food or the appetite of the bird. The curved beak necessitates the head being turned eye towards the ground in order to reach food from under obstacles. A large morsel requires much shaking in terrier fashion before it can be satisfactorily mastered and swallowed. This bird will often stop feeding and stand motionless for several minutes with one leg raised. Then it will violently shake itself several times, and, after a few refractory feathers have been coaxed into place, commence feeding again with what is undoubtedly renewed vigour. Sometimes it takes a short, sharp run, and then pauses with neck drawn in and one foot raised, the wings drooping below the tail. This is a position of extreme alertness. In this case, I suppose, some fortunate little crustacean, spotted by the wader at a distance of several yards, has managed to make its escape just in time. As with other birds, I have seen this species attempt to swallow pieces

of food much too large for it, and after wasting much time, finally give up the attempt. I often saw a bird shaking large pieces of weed; but whether the intention was to dislodge lurking crabs, etc., or to bite off little tender pieces of the weed itself, I cannot say. Perhaps it was for both reasons. When feeding, the Whimbrel pursues a zigzag course. When a small "drain" or gutter is reached, it runs down one side and up the other—not flying across, although, if the sides are steep, the wings are used to assist in mounting the opposite side. Perhaps on reaching the bottom the bird may change its course, and wade along the little creek, feeding as it goes. Or, in the course of its wanderings, a little pool may be discovered to be full of food. Then, standing thigh-deep in the slush, with both legs nearly straight and close together, it will get to work with many quick and dexterous thrusts of its long bill. The Whimbrel is very easily disturbed. The harsh croak of a Heron is sufficient to unnerve it. Up comes the neck, the tail is spread, and the bird starts to run, opening its wings at the same time, ready to take flight at a second's notice. More often than not, however, it is a false alarm; the wings are closed and feeding resumed. Like most waders, the Whimbrel, perhaps conscious of its own weakness where birds of another class are concerned, seems possessed of very little courage. It seems to especially dislike the marauding "Grey Gulls," often taking flight when one draws near. I have also seen a Whimbrel flee in haste before a Rook. It is usually a suspicious bird when feeding. If the presence of an enemy is suspected, but not absolutely ascertained, the bird glances over its shoulder and runs away for some distance without a probe; if the danger is not considered immediate it will feed away from the spot without exhibiting undue anxiety. When flushed at close quarters, the wings are heard to make a loud, swishing noise—almost as great as that produced by a Duck. When disturbed it will sometimes fly away without demonstration, but often the shrill call is uttered when it has gone about six yards, and then, after a pause, it fairly shrieks out again as it hurries away to a distant part of the flats. The flight is rapid and straight. The neck is drawn back and the bill held out in front with the point slightly inclined to the ground. The legs are stretched out to their fullest extent, and it seems that they are not held parallel, but that the feet nearly touch. The white rump is conspicuous in flight. When alighting, the Whimbrel sails for a few yards with wings extended and legs dropped down. Then, with wings raised above the back—showing the lighter undersides—and head thrown back, the legs are pushed forward and tenderly touch the ground, a movement full of

lightness and grace. The wings are not folded instantly, but after a slight pause. Feeding may be commenced the very next moment.

F. N. Chasen.

Odd Eyes, etc., in Pigeons.—As an old pigeon-fancier of many years' standing, and a regular reader of the 'Zoologist,' I should like to mention that the odd eyes in certain varieties of Pigeons, viz. Jacobins, Baldheads, and Beards, are of very frequent occurrence. All these varieties should be "pearl"-eyed; but nearly every breeder has had the annoyance of finding an otherwise certain Challenge Cup winner, with just this one fault, a "bull" "eye"—that is, a black or brown eye—on the one side and the beautiful pearl-eye, so necessary for the show bench, on the other, or "bull" eyes on both sides. One freak of one-sidedness which I noted many years ago, fully twenty, must be exceptional, and perhaps worth mentioning—that of a Turbit Pigeon, with one wing marked a clear blue, with deep black, well-cut bars, the other wing marked as a blue chequer, of a very dark even chequering; this bird was bred by Mr. T. Stretch, Ormskirk.—W. H. Parkin (Studholme, Shipley).

PISCES.

Fox-Shark in Malta.—On March 1st a Fox-Shark (*Alopecias vulpes*) became entangled in the Tunny nets at the entrance of St. Paul's Bay. The fish excited general curiosity, and though it has already been reported amongst our fishes by the late Professor Gulia, who states it to be rare, to all fishermen and fishmongers who have seen this specimen it seems to be a quite new occurrence. Along the Sicilian coast, where it is known as "Pisci surciu," it is said to be found commonly all the year round, but during the summer months especially. Our specimen measured 13 feet and weighed nearly 3 cwt.; its flesh was exposed for sale at the Valletta Market, and fetched about 1s. per lb. I procured for the Malta Natural History Museum the upper jaw and upper lobe of the tail-fin, which are quite sufficient for the identification of the species, and will also serve as a record of this rare occurrence in Maltese waters.—G. Despott (Malta).

INSECTA.

Black form of Peppered Moth in London.—I wish to inform you of an occurrence of the black variety of the Peppered Moth (*Pachys betularia*), which was found dead, and brought to me by a friend in July, 1913. I identified it by specimens in the Horniman Museum.—L. J. C. Harding (Clapham, London).

Notes on London Lepidoptera.—In my note on a Butterfly abroad in dull weather in the 'Zoologist' for last month (p. 114) the epithets "large white" should have had capitals, for the insect was undoubtedly the familiar *Pieris brassicæ*. I have seen *P. rapæ*, an even commoner insect, abroad under similar conditions; but in this case the specimen was evidently looking for shelter. I was once surprised at finding a fine specimen of the Small Copper on a hoarding in Great Portland Street, the only occasion on which I have seen this species in London. But more remarkable was the occurrence of a specimen of the Convolvulus Hawk-Moth on a balcony of the house formerly in the occupation of the Zoological Society in Hanover Square, some time in 1903 or soon after. This I boxed, and took up to Primrose Hill, and released it there that evening on going home.—F. Finn.

CRUSTACEA.

Hermit-Crab Capriciously Changing Shell.—What are the conditions, apart from growth, which lead the Common Hermit-Crab (*Eupagurus bernhardus*) to change its shell? Some individuals appear to change capriciously. For example, one captive specimen, of rather less than average size, removed from a Whelk shell (which bore a "Parasitic" Sea-Anemone) to another Whelk shell of about the same size; and in this house it remained for several days. It then returned to the first shell. A few days later it removed to a third Whelk shell. After remaining here for two or three days, it migrated to the first shell, on which the Sea-Anemone still stood. Neither of the two other shells bore Sea-Anemones, and all three were clean, and of about the same size. This behaviour is occasionally, but by no means commonly, to be observed in other individuals of the Hermit-Crab. It seems to have no connection with the presence or absence of a Sea-Anemone; and it is difficult to decide whether it has any connection with the presence or absence of the worm *Nereis fucata*.—H. N. Milligan.

ECHINOIDEA.

Cannibalism in a Sea-Urchin.—In a recent paper in the 'Zoologist' (pp. 81–99) on the feeding habits of the Purple-tipped Sea-Urchin I pointed out (p. 89) that it was probable that a Sea-Urchin ate the spines which fell from other Sea-Urchins, but that a specimen had not yet been detected in the act of eating a spine. The paper had been in print a week when I observed that a large Purple-tipped Sea-Urchin, 42 mm. in diameter (excluding the spines), had

seized a smaller specimen, 21 mm. in diameter, in the aquarium. The small one was making efforts to escape, but was followed by the large one. The small one crept into a corner of the tank, whereupon the large one imprisoned it in the corner with spines and tube-feet, and "sat" upon it for several hours until it had sheared off all except a few of the spines and tube-feet of the upper pole of the victim. So completely had this shearing process been carried out that not only was the test laid bare, but the rounded tubercles to which the spines articulate were in many cases scraped away. (I pointed out in my paper that the periostracum and rugosities of mollusc shells were similarly scraped flat.) The few spines left upon the upper surface had been broken off about their middles. The small Sea-Urchin was now rescued from its oppressor; but next morning I found that another Sea-Urchin, 23 mm. in diameter, had taken advantage of the helplessness of the victim to turn it over and scrape away most of the spine and tube-feet of the oral surface, the mouth-membrane being also bitten in several places. No spines could be found on the floor of the tank, and it may therefore be concluded that in both instances these had actually been swallowed. The small Sea-Urchin was now removed for safety to an empty tank; but it had been so badly damaged that it would neither eat nor move, but clung motionless to the vertical face of a rock with its few remaining tube-feet.—H. N. Milligan.

NOTICES OF NEW BOOKS.

The British Freshwater Rhizopoda and Heliozoa. By James Cash and George Herbert Wailes, F.L.S., assisted by John Hopkinson, F.L.S. Vol. III. Rhizopoda, Part III. London: Ray Society. 1915. 12*s*. 6*d*. net.

For this third volume of the Ray Society's monograph of our Freshwater Rhizopoda, which will be completed, we are told, by a fourth, Mr. G. H. Wailes is largely responsible, since the regretted death of the late James Cash left the work unfinished; his descriptions and records of localities have, however, been utilised, his name being appended to the local records, and some drawings by him are reproduced in the very full series of plates which, twenty-four in all, terminate the volume. Most are in black and white, but eight are coloured, and the text is also illustrated by line drawings of details, the degree of magnification being given in both cases. The groups dealt with include the families of *Euglyphina*, *Gromiina*, and *Amphi-*

stomina, of which the last is confessedly artificial, as we are told that, of the two British genera which it contains, *Diplophrys*, "beyond possessing the apertures in the test, has no affinity with the genus *Amphitrema*." It is of interest to find that microscopists are willing to put up with an unnatural classification, as well as the naked-eye systematists who are supposed to be so much less scientific; but we do not blame either for doing so when it is a question of getting out a needed faunal work like the present, since correctness of classification may well wait—so long as we realise our artificial groupings—till we know exactly what animals we have to deal with in every group and every country. The Protozoa dealt with in the present volume have been widely collected by various workers in our islands, Mr. Wailes making his acknowledgments to many providers of material, collected from districts as distant as the Shetlands and Cornwall, Cambridgeshire and Ireland; but, he tells us, much more "remains to be done before we can gain any correct idea of the distribution of the Freshwater Rhizopoda throughout the British Isles," and it is hoped that microscopists will come forward with their local records—to which, we may add, our pages will always be open; we could do with many more short notes. A sketch of the life of James Cash, the chief author of the first two volumes of this work, appropriately opens the present volume; he was not a professional naturalist, but a journalist, employed at first on the 'Warrington Guardian,' and afterwards, from 1867 till his death, at the age of 70, in 1909, on the 'Manchester Guardian.'

The Colchester Oyster Fishery. By HENRY LAVER, F.S.A. Colchester: Benham & Co. 1916. 2*s.* 6*d.* net.

As Chairman of the Colne Fishery Board, Dr. Laver is an authority on the long-famed Colchester Oysters, and he deals in full detail in this remarkably neat little work, well illustrated with photographs, with the antiquity and position of this Oyster fishery, the methods of working it, and the quality and safety of its products. The value of the Oyster, not only as a choice article of food, but as an invaluable recuperative diet in cases of dyspepsia and weakness, is supported by numerous instances, and in times like the present is particularly worthy of being held in mind. A silver Oyster is kept among the Colchester Corporation regalia, this being used as the standard of the size and form of the Oyster considered the best and most suitable for sale, and this is figured in the book. Other useful illustrations depict the enemies of the Oyster, spat-shells and brood, the measures used, and the actual adult Oysters themselves.

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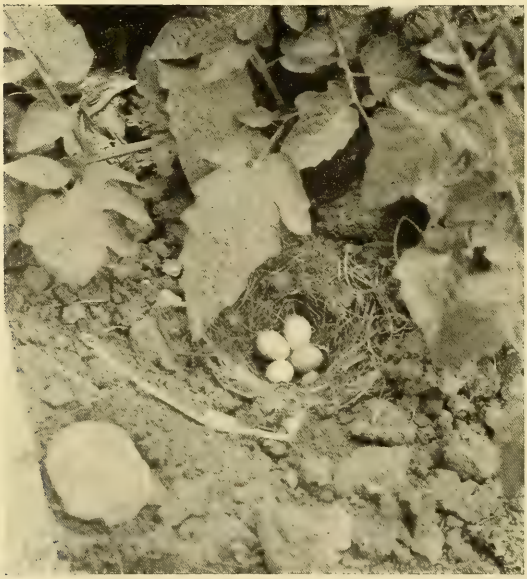

NEST AND EGGS OF SHORT-TOED LARK UNDER COVER OF TOMATO PLANT.

THE ZOOLOGIST

No. 899.—May 15th, 1916.

THE BREEDING BIRDS OF MALTA.

By Giuseppe Despott, M.B.O.U.
(Curator Nat. Hist. Museum, Malta.)

Besides the paucity of trees and the want of many other conveniences indispensable for breeding birds, another reason why the number of our breeding species is so very limited, and nidification with the majority of these occurs rather sparingly, is assuredly want of protection.

The number of both licensed and unlicensed sportsmen and fowlers is so large that very few chances of breeding are given to the birds.

Such a thing as a close-season is not known in Malta, and yet, for some species, it is "a consummation devoutly to be wished" by all except the purely wanton sportsman.

This limited number of our breeding species may account for the fact that no one has ever been encouraged to take up the study of this branch of our ornithology; in fact, so far as I am aware, nothing has ever been published except a few occasional notes in Schembri's and Wright's catalogues; and of these some are probably given on the statements of very superficial observers.

I have often heard that nests of such species as the Nightjar, Hoopoe, Oriole, Bee-eater, Roller, etc., have been found, but the replies to my queries regarding site of nest, constructory material, number, colour, and size of eggs have invariably been so unsatis-

factory, that I feel justified in excluding them, at least for the present, from our list.

I began what I may call an idle collection of birds' eggs in 1898; this, however, gradually induced me to take a keen interest in our breeding species, and from 1900 I began to be more scrupulous and moderate in my collecting, and also to accompany such collections with the necessary notes; with the result that, omitting those which I have not yet seen myself, the list of the breeding birds of Malta to date has been brought up to thirty-two.

As will be seen from the list, it is difficult to fix the rate of nidification for several species; the rare Dartford Warbler, for example, nested freely enough in 1910–11, while the Corn-Bunting, which is one of our common residents and breeders, nested so sparingly in 1911 that I was not able to procure more than one nest.

Some species which once nested abundantly have now become so rare that I am afraid my having included them in this list might one day give rise to much controversy. Amongst these may be mentioned the Mediterranean Shearwater, which is being rapidly exterminated from these islands. Noteworthy also is the total absence of Marmora's Warbler in 1909, 1910, 1911, and 1914.

Before beginning my list I must say that I do not by any means pretend it is complete; on the contrary, I quite believe that it might easily be enlarged, especially if some species were speedily and seriously protected.

1. Blue Rock-Thrush.

Monticola cyanus, Linn.—Merill.

This bird, being our best songster, is in great demand among bird-fanciers; consequently it is continually diminishing in numbers, and, though in 1911 it found a place on the list of the protected birds, it is still being robbed of its nestlings as it was before. Fortunately, the site which the bird selects wherein to build its nest is a crag in those inaccessible rocks overhanging the sea towards the south of the island, or high

up in some ruined building which it is impossible to climb without running the risk of being buried beneath it.

The nest is a rather bulky but loose structure of coarse roots and hay; both male and female take part in its construction, and they take from fourteen to fifteen days to complete it.

Nidification commences in March and lasts till the end of May. Two broods are generally reared in a season, the nest being sometimes partially, and sometimes entirely reconstructed for the second brood.

The eggs vary in number from five to seven, six, however, being the usual number. Their colour is a sky-blue, varying somewhat in intensity, some specimens being thickly spotted, others only sparingly, with reddish brown. A variety is sometimes met with having no spots at all.

2. Whitethroat.

Sylvia cinerea, Lath.—Beccafic ahmar.

The Whitethroat, which during some years visits us in considerable numbers, both in Autumn and in Spring, is by no means a common breeder; on the contrary, from my personal experience, I can say that it must be considered very rare.

I have found only four nests, all of which consisted of a light construction of dry grass; three of them had some horsehair and wool as an inside lining. In shape they were rather deep, and they were built in carob-trees at various elevations from the ground.

The eggs, from four to five in number, were of a greenish-white colour clouded with grey, and speckled all over with several shades of brown.

Three of these nests I found from the middle to the last week of April, and one during the second week of May.

3. Garden-Warbler.

Sylvia hortensis, Bechst.—Beccafic.

This is a rather common Warbler which visits us during both passage-seasons, but especially in Spring. Every now and then a pair or two are found nesting.

The nest is usually built in the smaller carob-trees; it is a rather loose construction of hay and dried grass, with an inside lining of roots and horsehair; both the male and female take part in its construction, and it is ready in six or eight days.

The eggs, which vary from four to five in number, or sometimes even six, are of a stone-colour spotted with grey and several shades of brown; specimens are sometimes met with having very bold blotches.

I always found these nests in April, and do not know of a single case of their being found during other months.

4. Spectacled Warbler.

Sylvia conspicillata, Marm.—Buchajla.

Of all our Warblers this is certainly the most common, being found also all the year round; as a breeder it must be considered as very common.

Though it also builds its nest in carob-trees, it seems to have a predilection for dwarf plants.

The nest is a fine compact construction of dried stalks of grass and fibrous roots, thickly interwoven with wool and vegetable down. The inside is generally lined with different kinds of hair and finer roots; on the outside rags and even bits of paper are sometimes found making part of the constructing material. In shape these nests are mostly deeply cup-shaped. Both male and female take part in their construction, which takes them from six to eight days to complete.

The eggs, which are very small, are from five to six in number; their colour is a light bluish-green or grey speckled with olive, and sometimes clouded with darker grey or light brown; the speckling often forming a zone about the larger end.

This bird is one of our earliest breeders, often beginning to nest by the middle of February, and goes on to the end of May. Two broods are usually reared during a season, though a third one is by no means a rarity.

Schembri says that this species arrives here in April but not in September, and that it nests here in May. Wright says that it builds its nest in the *Euphorbia dendroides*; I have never found, however, any bird selecting this plant in which to build its nest.

5. Sardinian Warbler.

Sylvia melanocephala, Gmel.—Buswejda.

This bird is rather irregular in its visits, both in Spring and Autumn; during some years, however, it arrives in fairly good numbers, especially during the Spring, when it remains with us to breed.

The nest is usually built in trees; the bird, however, does not seem to be partial to any tree in particular. In fact, I have found nests in carob, almond, pomegranate, fig, and orange trees, and on two occasions also I found it in the vine.

In structure, too, these nests vary considerably, some being very compact and deeply cup-shaped, others very flimsy and flat; the construction-material consists of hay and several kinds of dried grasses, with large leaves on the outside, the inside being lined with fine rootlets and horsehair; nests are, however, often found having no inside lining at all.

Both male and female are employed in the construction of the nest, which is brought to completion in about a week.

The eggs, which vary in number from five to six, vary also greatly in colour; some are of a light grey colour speckled over with brown, others are of a bluish-white speckled with olive and purplish-grey; a third variety, which is common too, is pink or light red mottled over with chocolate or darker red; a fourth variety, which is the rarest of all, is of a pure white, sometimes very sparingly spotted with brown.

Nidification usually lasts from the beginning of March to the end of May, and two broods are usually reared during a season—sometimes, but very rarely, three.

It is rather curious that Wright says that he had never known this species to breed here.

6. Subalpine Warbler.

Sylvia subalpina, Bonelli.—Ghasfur il harrub.

This species, which is generally a rare migrant during both seasons, nests here every now and then.

It usually chooses some low herbage wherein very skilfully to conceal its nest, which is constructed with dry blades of grass on the outside, and fine roots on the inside; here horse-

hair is often added as a lining. I could never make out how long the birds take to build it.

The eggs, generally five in number, very rarely six, are of a light greenish-white boldly speckled with olive-brown.

I found nests in March, April, and May.

7. Orphean Warbler.

Sylphia orphea, Temm.—Beccafic abjad.

Of this species, which is one of our rare Spring and Autumn visitors, I found five nests in 1907. All of them were built in the larger carob-trees, at a position somewhat elevated from the ground. Of these five nests, I must confess only one was identified from the sitting bird; the other four, however, being identical with it in shape, position, and construction-material, also in the size and colour of the eggs, I think I am quite justified in ascribing them to this species.

In structure these nests were rather loose, though cup-shaped, the material used in their construction being dried stalks of grass and fine roots; they were very sparingly lined with vegetable down, and one nest had some skeleton leaves of the thistle interwoven in the outside.

The eggs, four to five in number, were of a greenish-white speckled all over with light olive and grey, the markings being more confluent about the thicker end.

Two of the nests I found in April, the other three in May.

8. Dartford Warbler.

Melizophilus undatus, Bodd.—Ghasfur tas'sigiar ahmar.

This very irregular and rare visitor was included in Schembri's catalogue on the authority of Dr. Grech Delicata, and the same fact was also reported by Wright. This rarity might perhaps be due in part to the bird's retiring habits, frequenting as it does dense foliage, and very seldom taking to flight, and thus easily escaping detection by even the keenest observer.

It seemed to be pretty common in 1910–11, during which years I found several nests, only three of which were identified from the sitting bird; the others, however, being identical with them in every respect, I ascribe them to this species. All of

them were very well concealed in shrubs growing in the thickest parts of valleys, especially at Wied Zembak. Their construction-material consisted of dried stems and withered blades of grass; roots were used in only two of the nests, but wool and vegetable down were found, though rather sparingly, in every one of them; in structure they were rather loose.

The eggs, from three to five in number, are of a greenish or yellowish white speckled over with light grey, olive, or brown; in some eggs this brown is conspicuously reddish, and the blotches are rather bold. I may add that the eggs were identical with several I received from Italy.

All the nests were found during April and May, except one, which was found in March. I could not make out if both male and female take part in the building of the nest, nor the length of time they take to complete it.

9. Marmora's Warbler.

Melizophilus sardus, Marm.—Bufula.

This Warbler, which is fairly common, is to be met with in these islands during the greater part of the year. I remember, however, several years when I could not see a single specimen; during the years 1909–10–11, for example, I could not procure a single specimen, and so also in 1914.

The nests are usually built in the carob-trees, and are composed of hay and dried stalks of grass, lined with rootlets and sometimes horsehair on the inside. Both birds take part in the construction, in which they employ from eight to ten days.

The eggs, four to five in number, are of a pale greenish-grey speckled over with darker grey and brown, the specks very often forming a zone about the thicker end; some eggs are somewhat glossy.

Nidification lasts from the beginning of March to the middle of May.

10. Grey Wagtail.

Motacilla melanope, Pall.—Zacac tad-dell.

As a migrant this bird is fairly common, especially during the Autumn, and a few individuals often pass the Winter with us; these generally remain here to breed.

The site chosen for the building of the nest is a depression of the earth, usually under cover of some low herbage, and most frequently in the vicinity of water.

I have not been able to make out yet if both birds take part in its construction, nor how long a time they employ in completing it.

The material used consists of blades of grass and rootlets, fairly lined with vegetable down and hair.

The eggs, four to six in number, are of a greenish-white colour, speckled all over with darker grey and brown.

Nidification takes place from March to May, in which time two broods appear to be reared.

Both Schembri and Wright admit that this is one of our breeding species.

11. Woodchat Shrike.

Lanius auriculatus, Mull.—Cacciamendula.

This bird, which is a partial resident with us, was once very common; lately, however, it has greatly diminished in numbers, and seems to be constantly on the decrease. As a breeder, too, it was very common, but now it must be considered rare; so much so, that during the last three years I have not seen more than seven nests, and yet I searched for them most diligently.

The site chosen for the building of the nest is a forked branch of a large carob-tree, in a somewhat elevated position from the ground. Schembri and Wright say that the nest is often found in almond-trees; I have never found it, however, except in the Carob.

It seems that only the female is engaged in the construction of the nest, in which she employs from eight to nine days.

The nest is very neat and compact, being generally composed of a particular kind of plant, finely lined with the down of the same plant, and interwoven with wool.

The number of the eggs varies from five to six, the last, however, being the usual number. Their colour is generally white faintly tinged with greenish-blue, and boldly speckled with grey and brown, in the majority of specimens the blotches forming a very conspicuous zone about the thicker end; in some rare cases the eggs seem to have a faint gloss.

Nidification generally lasts from the beginning of May to the end of June, one brood being generally reared during a season.

12. Goldfinch.

Carduelis elegans, Steph.—Gardill.

This beautiful species, which visits us during both passage-seasons, is generally scarce. I remember some years, however, in which it arrived in considerable numbers.

Both Schembri and Wright admit that it has been known to breed here, and though I have been assured by several persons that a nest or two are found nearly every year, I have only seen one myself. This was built in a small tree in one of the large gardens in the vicinity of Siggiewi; in structure it was very compact and deeply cup-shaped. The material composing it was the common moss found growing on the trees in the same garden, fine grass, and rootlets; the whole was interwoven with wool and what was most probably thistle-down. On the inside it had a lining of horsehair.

I was told that the nest was built in eleven days, but I could not find out if both male and female took part in its construction.

The contents of the nest consisted of four newly hatched birds and an addled egg. The colour of this egg was white faintly tinged with blue, spotted all over with reddish brown, the spots being more confluent about the larger end.

The nest was found on May 21st, 1913.

13. Serin-Finch.

Serinus hortulanus, Koch.—Apparell.

Though the Serin is a fairly common migrant during the Autumn, and in some years is seen in very large flocks, which generally remain throughout the Winter, it seems to be only an accidental breeder in these islands. It would perhaps breed more frequently if it were not so much persecuted, and destroyed in such great numbers by means both of the clap- and bat-nets.

The only nest I have found myself was built high up in a large carob-tree at the bottom of Wied Dalam; it was a rather

compact structure of hay interwoven with wool and goat's-hair, and having an inside lining of vegetable down and a few feathers.

I could not make out how long the bird took to complete it, nor if both sexes took part in its construction.

It contained five hard-incubated eggs, which six days later hatched; the colour of these eggs was a faint bluish-white, very sparingly spotted with dark-brown; purplish-grey spots were noticeable about the larger end.

This nest was found on May 4th, 1910.

I was told that in April, 1914, another nest was obtained from the same locality by a local egg-collector.

14. Greenfinch.

Ligurinus chloris, Linn.—Verdun.

As a bird of passage the Greenfinch is usually common, but as a breeding bird it is here exceedingly rare. It generally begins to arrive towards the first week of October, and continues till late in November. Fresh arrivals are often noticed in January; towards March, however, all of them depart.

Though I have often heard from other observers that its nests are sometimes found, I have only succeeded in finding but one myself, and this was in May, 1910. It was built in an olive-tree at St. George's Bay (San Giorgio a Mare); in structure it was rather bulky but neat, being composed of hay, withered leaves of the common wormwood, and some fine straw on the outside, the inside having a lining of fine rootlets, hair, and a few feathers.

Both sexes took part in its construction, which they completed in ten days.

The eggs were four in number, their ground-colour white, very faintly tinged with blue and spotted with reddish brown, more confluently about the thicker end.

15. Spanish Sparrow.

Passer hispaniolensis, Temm.—Ghasfur tal beit.

This is the Common Sparrow of Malta, and certainly our most common breeder too; it builds its nest in holes of walls, in fissures of rocks, and sometimes also in trees, both out in the country, in villages, and in towns.

The nest is a very rough and bulky structure of straw, hay,

grass, feathers, rags, wool, and paper ; in fact, everything seems good for this bird to add to the bulk of its nest.

Both sexes are employed in the construction of the nest, which is completed in a period varying from seven to twelve days ; the same nest is usually used for a second, and sometimes even a third brood during the same season.

The eggs vary in number from four to six, five, however, being the usual number ; their ground-colour varies from a pure white to a dark-bluish or greenish-white, speckled over with greyish- and blackish-brown spots and blotches; some specimens are covered all over with these blotches, while others are found having no markings at all.

Nidification lasts from the end of January to the end of July or beginning of August, and so prolific are these birds that as many as four broods are often reared in a season. In spite of this, however, so persecuted are these birds that it has often been felt that their temporary protection was desirable.

In September the majority of these birds migrate, and return by the beginning of March, so that the early breeders are certainly those which have passed the Winter with us.

I have seen a nest containing five unfledged birds during the last week of October, 1915, a fact surely of very rare occurrence.

16. Linnet.

Linota cannabina, Linn.—Giojjin.

The Linnet is one of our most abundant birds of passage during the Autumn ; by the middle of October the first arrivals are noticed, and towards the beginning of November the country is literally full of them. Both the clap- and the prohibited bat-nets are now used to such an extent that the numbers of the birds are quickly and greatly reduced, the poor Linnets being taken and slaughtered by thousands. Thus when Spring arrives only a few pairs are to be seen, and these generally nest, very often to be robbed of their nestlings too.

I have found the nest always in the carob-trees, though I have been assured that it is sometimes built in the ivy and other climbers.

Both male and female are employed in the construction, which they generally complete in about eight days.

In structure, with only a few exceptions, the nests are rather loose; so loose, in fact, that it is very difficult to keep them in shape once they have been detached from the branches. The material used is hay and withered blades of grass; rootlets, hair and vegetable down, though very sparingly, are often used as an inside lining.

The eggs, four to five in number, are white, speckled over with purplish-brown. I noticed some nests in 1910 in which the eggs were conspicuously blue.

The breeding season for the Linnet in Malta generally lasts from the middle of March to the middle of May. The earliest date on which I found freshly-laid eggs was March 8th.

17. Corn-Bunting.

Emberiza miliaria, Linn.—Durrajsa.

The Corn-Bunting is one of our common resident and breeding species. It was much more abundant a few years ago; its present diminution being perhaps due to the great demand for its eggs among dealers on the continent. In February fresh arrivals are often noticed.

The nest is usually placed on the ground in a depression of the soil under cover of some dwarf herbage, very often amongst the withered leaves of the *Asphodelus ramosus*. Sometimes, but very rarely, it is found on the lower branches of the carob.

Both sexes take part in its construction, which they complete in nine or ten days.

The nest is rather bulky, but neat and compact; it is made of fine roots on the outside, having an inside lining of horsehair. In nests which are found not far from the seashore seaweeds are generally found as part of the construction-material.

The eggs vary in number from four to six, the last being, however, the usual number. In colour they vary from a delicate creamy-white to almost a light reddish-brown, speckled over with brown and black, and often having very irregular scribblings, which are generally more confluent about the thicker end.

Nidification lasts from the middle of February to the end of May.

18. The Short-toed Lark.

Calandrella brachydactyla, Leisl.—Bilbla.

With the exception of the Sparrow this is certainly our most common breeder. The first arrivals are noticed by the beginning of March; the bulk of the birds, however, are not seen before April, when great numbers are taken by means of the clap-nets.

The nest is always placed on the ground in a depression of the soil under cover of a thistle or some other small plant. Arid localities are generally chosen. The colour of both eggs and nest harmonises so well with its surroundings that the nest is very difficult to be detected, even by the most experienced collector.

I could never find out if both sexes work at the nest, nor the time they employ in its construction.

The material used for the making of the nest is usually very scanty, and consists of roots and grass very roughly put together; in nests found not far from the seashore the same seaweed (*Caulinia oceanica*) used by the Bunting is frequently noticed too.

The eggs vary in number from three to five, very rarely six; their colour is a fine creamy-white or a dirty clay, clouded and speckled all over with several shades of brown, olive, and grey, some having a zone of these spots about the thicker end; some eggs are noticed having a rather conspicuous gloss. In shape the variation is also great. Specimens are found which are quite spherical, while others are markedly elongated; great variation is at times noticed even in the same clutch. Nidification commences late in April and goes on till the end of July.

19. Lesser Short-toed Lark.

Calandrella minor, Cab.—Bilbla seconda.

This Lark is by no means common in Malta; it seems, however, that the few individuals which arrive in April together with the preceding species remain here to breed.

The site and construction of the nest are identical with those of its larger ally, and the colour and often the size of the eggs are also the same, so that sure identification can only be had by

also taking the sitting bird. I have often found eggs of the Short-toed Lark even smaller than those of this species.

The period of nidification lasts also from the end of April to the end of July.

20. Jackdaw.

Corvus monedula, Linn.—Ciaula.

It is said that in other countries few are the places where the Jackdaw cannot find a home. Well, it must be said that in Malta few are the places where it can find one, such is the persecution the poor bird suffers all the year round, and during the breeding season especially.

The very limited number of birds which still remain nest in the crevices of the inaccessible cliffs overhanging the sea towards the south of the islands. A few years ago, however, these birds could be found nesting in old steeples and towers, and even in holes in the old battlements surrounding the towns. I remember also the time when the Jackdaws could be seen on the roofs of houses in the centre of Valletta.

Both sexes take part in the construction of the nest, which they complete in about a fortnight.

This nest is a rough structure of straw, hay, and some feathers, wool and hair being also found at times.

The eggs vary in number from four to six; in colour they are of a pale greenish-blue, mottled over with light and dark brown spots, some specimens very thickly, others only sparingly. I have seen specimens very boldly blotched.

Nidification lasts from the beginning of April to the beginning of June, and only one brood appears to be reared during a season.

If speedy protection is not afforded to this bird I am afraid that its extinction as a breeding species in Malta will be a question of the very near future.

21. Swift.

Cypselus apus, Linn.—Rundun.

The Swift, which is one of our commoner birds of passage, and also a partial resident, may be also considered a pretty

frequent breeder. If one can judge by the great number of birds which during the breeding-season are seen flying about the southern cliffs, and entering their crevices at intervals, it must be said that the Swift is one of our more common breeders.

The only nest I ever procured was taken from a crevice in the precipitous cliffs close to Ghar-Hassan (Hassan's Cave) in May, 1909. It was composed of straw, hay, feathers, and some cotton; I cannot say what its shape was like, as it was brought out in pieces.

Both sexes take part in the construction, which, I have been assured, is sometimes completed in so short a time as four days; sometimes, however, so long as ten or eleven days are taken to complete it.

The eggs, two in number, and very conspicuously elongated, were of a dirty white, seemingly spotted; these spots were, however, easily removed by means of a little rubbing.

22. Short-eared Owl.

Asio accipitrinus, Pall.—Omm-is-subien.

This Owl is one of our common visitors during both seasons; its nesting here, however, must be considered an event of very rare occurrence, though it has also been recorded as a breeder both by Schembri and Wright.

The first time I saw a nest was on May 4th, 1906; it contained five young, and was found in the vicinity of Siggiewi in a depression of the soil under a tree. On May 18th I found another among the low grass at the bottom of Wied Znuber. It contained three eggs, which were of a pure white colour, having a very faint gloss; in size they were a little larger than Pigeons' eggs, and more spherical in shape.

23. Barn-Owl.

Aluco flammeus, Linn.—Barbagianni.

Though by no means common, this Owl being sedentary, one or two of its nests are found nearly every year; unhappily, however, it is being most rapidly exterminated, and I am

inclined to think that the nests which are found belong to birds which have but freshly arrived.

The site chosen by this bird wherein to nest is usually a deep crevice of the high rocks on the south of the island, or in the more unfrequented parts of some of our valleys.

The same nest is generally used again, not only during the same season, but for many successive years.

I have never been able to examine a nest myself, but I have been told that very little or no material at all is used, the chalky-white eggs, two or four in number, being often laid on the bare earth. The breeding of the Barn-Owl in the ruined walls of Valletta and the three cities (which both Schembri and Wright mention), must be considered now a thing of the past.

The breeding-season commences in April, and freshly-laid eggs have been found even as late as the beginning of August; and more than one brood is generally reared.

24. Hobby.

Falco subbuteo, Linn.—Seker tal hannieka.

The Hobby, which is usually a common visitor during both passage seasons, but especially during the Spring, has been known, though rarely, to nest here.

I obtained one nest on May 12th, 1910.

The material of which it was composed consisted of old straw, small twigs, and some very dirty feathers belonging to domestic birds.

The eggs, three in number, are of a creamy-white colour, so thickly mottled over with light red and brown as to hide the ground-colour almost entirely, and thus give them the appearance of a uniform light red mottled over with several shades of brown.

I am inclined to think that this is the Falcon alluded to by Schembri and Wright as being a resident and breeder here, and not the Peregrine, which is here very rare.

25. Kestrel.

Falco tinnunculus, Linn.—Spanjulett.

The Kestrel is one of the most common species of its genus which visits us during both passage-seasons, and it might be

considered also one of our resident species, as a few individuals are to be met with all the year round. Its nests, though not common, are to be found every year.

The site chosen by the bird wherein to nest is generally a crag in the cliffs overhanging the sea towards the south of the islands; the material used being identical with that employed by the foregoing species. Some observers are of opinion that the Kestrel often uses the nest of the Jackdaw after having compelled its owner to desert it. When it really makes a nest for itself, both male and female seem to take part, and they generally employ from six to fifteen days to complete it.

Nidification commences rather late. I have never seen a nest earlier than in May. The young seem to leave the nest by the end of June.

26. Rock-Dove.

Columba livia, Bonn.—Hamiema tal gebel.

This is one of our resident birds; it is, however, by no means common. Evidently Wright, who says that it breeds in considerable numbers, was not aware that the bulk of the birds which are seen about the southern parts of the islands are nothing but escaped examples of the several varieties of our domestic pigeons.

The site chosen by the Rock-Dove wherein to nest is generally a crag or a cave in the high southern cliffs.

Both sexes take part in its construction, which they complete in a period varying from six to ten days. The nest seems to be used not only for several broods but for several successive years.

No description of nesting-material or eggs is needed, as these are quite identical with those of the domestic pigeon.

I fear that it is difficult to fix the length of the nesting period, though some observers are of a persistent opinion that it lasts from March to July.

27. Quail.

Coturnix communis, Bechst.—Summiena.

Undoubtedly the Quail would be one of our more common breeders if it were not so much persecuted; unfortunately,

however, it is so eagerly sought for that very few chances of breeding are left to it.

The nest consists simply of a depression of the soil, mostly scratched out and enlarged by the bird itself, and practically no material whatever is used as a lining. The site chosen is usually in the sulla or corn fields.

The eggs, often sixteen in number, and sometimes more, are of a creamy-yellow colour, spotted with chocolate and several other shades of brown; in some specimens the markings are rather minute; in others, however, they consist of very bold blotches, some of which are of a size as to cover, say, an eighth of the egg.

Nidification usually commences in March; I have seen, however, eggs still unhatched in June.

28. Stone Curlew.

Œdicnemus scolopax, S. G. Gmel.—Tellerita.

This bird is one of our common migrants during both passage-seasons, and may be considered also a partial resident, as a few individuals may be met with almost all the year round.

I must confess that I doubted for a long time about the truth of the statement that this bird is to be considered one of our breeders. On June 26th, 1909, however, a bird in down was brought to me; it was taken about the barren rocks between "tal Mara" and "Ghar Hassan." On June 2nd, 1911, two freshly-laid eggs were also brought to me; they were found at "Gzira," another barren locality in the vicinity of Siggiewi.

I have never seen a nest, but I have been told that the eggs are simply laid in a depression in the ground, with no material beneath save the bare earth; and I have been also assured that at "Marfa" the same spot is used by the birds for nesting year after year.

In colour the eggs are of a dirty ochre mottled all over with several shades of brown, and having also some very distinct streaks of this colour.

29. Southern Herring-Gull.

Larus cachinnans, Pall.—Gawwija prima.

This fairly common bird is to be considered as one of our

constant breeders; it seems, however, to breed more commonly in Gozo than in Malta.

The site of the nest is generally a crag or a shelf of the cliffs overhanging the sea, the material used consisting of sticks and seaweeds; the nest is sometimes very bulky, but always roughly and loosely constructed.

The eggs, from two to three in number, are of a yellowish clay-colour, blotched with olive and several shades of brown; in some specimens the markings are very bold, thus giving the egg a very beautiful appearance.

Nidification generally takes place from March to May, and only one brood seems to be reared in a season.

The young in down are often taken and exposed for sale on the square opposite St. John's Cathedral; being very susceptible of domestication they are often kept as pets, and can be seen strolling about the streets. One or two are often to be seen also in our public gardens.

(This is, of course, the *Larus argentatus* reported in Wright's catalogue.)

30. Storm-Petrel.

Procellaria pelagica, Linn.—Cangiu ta Filfla.

This is a rather abundant species, and, being also resident, it is to be considered common as a breeder too. Though it is stated to be found only on Filfola (hence its Maltese name), I have no hesitation in saying it is to be met with all around the Maltese islands. Its true breeding station, however, is really the islet of Filfola; there it lays its single egg in the deep crevices of the rocks, or under the large stones, whence it is very difficult to get it.

The egg is white, smooth, and without any gloss, sometimes spotted over with minute reddish spots, which are generally more confluent about the thicker end, where they often form a zone.

Sometimes two birds or more select the same crevice in which to lay each its single egg; this fact has led some observers to think that this petrel lays more than one egg.

Very little or often no material at all is used, and the egg is simply laid on the bare earth.

The breeding-period lasts from May to the end of July or the beginning of August.

31. Levantine Shearwater.

Puffinus yelkouanus, Acerbi.—Garnia.

This species, reported in both Schembri's and Wright's catalogues as the Manx Shearwater, is one of our sedentary species. It was once rather common, but has now become rather scarce.

The site chosen by the bird for nesting is a deep crevice or one of the rabbits' burrows so frequent along the southern coast of the island.

A single egg is laid, which is of a pure chalky-white colour; in size it varies considerably; this variation equals that of the eggs of the domestic hen, and as such it is often offered for sale.

The breeding-season of this species commences towards the beginning of April and goes on till the end of May.

Often more than one egg or nestling is found in the same burrow; these are certainly, however, the produce of two or more females.

32. Mediterranean Shearwater.

Puffinus kuhli, Boje.—Ciefa.

This species, which was once very numerous, has been much reduced in numbers, so much so that its extermination here, unless something is done to protect it seriously, will be a question of the very near future.

The bird used to breed most freely on all the islands composing this group, and on Filfola, their chief breeding station, they could be found breeding in hundreds, not to say thousands.

The single chalky-white egg is laid in a depression of the soft turf under the shelter of some large stone or in a crag in the rocks; sometimes it is simply laid on a sort of thick low herbage found growing all along the cliffs overhanging the sea, and especially on Filfola.

In size this egg is a little larger than that of the foregoing species, but, like it, it also varies considerably.

It is generally laid towards the end of May or the beginning of June, that is, about two months later than that of the Levantine Shearwater.

Note.

Besides the thirty-two species just mentioned the following have also been noted as breeding here; this, however, I have not yet been able to confirm :

(1) The Bee-eater, reported by Schembri on the authority of others, the same statement being repeated by Wright.

(2) The Kingfisher, reported also by Schembri in a somewhat vague manner.

(3) The Roller, reported also by Schembri, who had heard that it bred once.

(4) The Turtle-Dove, reported by both Schembri and Wright in a rather doubtful manner.

(5) The Sandpiper, reported by Wright, who says that "it probably breeds here."

THE PHARYNGEAL TEETH OF FISHES.

By Colonel C. E. Shepherd (Indian Army).

(Concluded from p. 73.)

Lophiidæ.

Lophius budegasa, a Mediterranean fish of the "Angler" description. The upper pharyngeal teeth show as three rows of strong cardiform teeth, the two upper rows being larger than the lowest and third row. The lower pharyngeal teeth are in two elongated groups, each forming a V, the point of which is towards the tongue; there are prominent upstanding cardiform teeth marking each line of the V, and there is a broad space between the V's in the middle line; the apices of the V's converge towards the front of the mouth (fig. II. 3, p. 71).

Lophius piscatorius, the Angler or "Fishing Frog," found on the English coast, has its upper pharyngeal teeth likewise in three rows. The top row, on the head of the second epibranchial, has strong cardiform teeth, the second row, on the head of the third epibranchial, has still stronger teeth, and the third row, on the head of the fourth epibranchial, is of smaller teeth; all, however, being cardiform. The lower pharyngeal teeth are similar to those described for *L. budegasa*.

Molidæ.

Orthagoriscus mola (the Sunfish), has the upper pharyngeal teeth in three rows each side of long, slender, but imposing-looking cardiform teeth. A specimen can be seen in the annexe, off the Central Hall, devoted to details of the anatomy of fishes, at the British Museum of Natural History.

Paradoxical as it may appear, the subject of the pharyngeal teeth of fishes would not seem to be completely dealt with without some mention of those families of fishes which are devoid of such teeth.

Polypteridæ.

Polypterus senegalus, a fish found in the rivers of West Africa. A few flat, tubercular patches with very fine villiform teeth on the outer and inner sides of the first three arches represent all that this fish has for gill-rakers. There are no pharyngeal teeth (fig. III., 1).

Acipenseridæ.

Acipenser sturio, the Sturgeon, has twelve short, horny gill-rakers on the first cerato-hypobranchial, with six on the epibranchial. They are placed low down on the outside of the arch instead of standing on the upper edge. The longest is one-fifth of the depth of the gill-laminæ below it; these gill-rakers stand up distinctly apart from each other. The inside of the first arch, and both sides of the second, third, and fourth arches, have short, upstanding, horny gill-rakers much more numerous than those on the outside of the first arch, the inside of this having twenty-two gill-rakers; they are, however, less broad in structure, and stand out like a row of little pegs. There are no pharyngeal teeth.

Ceratodontidæ.

Neoceratodus forsteri, a fish that breathes by lungs as well as by gills, is found only in two or three rivers of Queensland, Australia, and said to be getting extinct there. It is called locally the "Flat-head," also "Burnett" or "Dawson" Salmon, according to the river in which it is caught. It has sixty-two short, fleshy gill-rakers from the extremity of the first epibranchial to the end of the first hypobranchial. The angle not being clearly defined, the total number is noted. The longest are only one-tenth of the depth of the gill-laminæ below them. There are forty-two similar gill-rakers on the inside of the hyoid bone, shown opened back in the illustration. There are similar gill-rakers on each side of the gill-slits, those on the inner sides being longer than those on the outside. The upper surfaces of the arches are covered with fleshy papillæ of a bluntly-pointed shape, those on the first arch being triangular. At the junction of the hypo- with the basibranchial are bigger, broader, but still pointed papillæ. The upper back part of the gullet is marked with corrugations that fit over the gill-slits, and the whole

surface of the back part of the gullet is covered with papillæ which are more thickly congregated just above the œsophagus (fig. I.).

MORMYRIDÆ.

A family of fishes found in the Nile and other rivers of tropical Africa.

FIG. I.

Mormyrus kannume, from the Nile, has only five small gill-rakers on the first cerato-hypobranchial arch, with four very minute ones on its epibranchial. There are also minute gill-rakers on the inside of this arch. Both sides of the second and third arches and the outside of the fourth arch carry minute but more numerous gill-rakers. There is a long strip of minute teeth on the tongue up to the junction of the second gill-arch.

Hyperopisus bebe, also a Nilotic fish, has thirteen minute gill-rakers on the first epibranchial. There are no gill-rakers on the cerato-hypobranchial of the first arch, nor on the other arches. There is a set of granular teeth on the tongue, arranged at the forward end as the seeds of maize on an Indian corn cob; at the hinder portion of the tongue these teeth are arranged in an outer circle with an inner area of mucous membrane. The palate of this fish is covered with a strong bony plate that has rounded teeth studded on it, against which the teeth on the tongue engage.

Hyodontidæ.

Hyodon alosoides, a fresh-water fish, the Mooneyes of Canada, has eight short, thick, horny gill-rakers on the first cerato-hypobranchial arch; these are not teeth-bearing. There are four on the epibranchial. The longest of the gill-rakers is, in length, just under one-third of the depth of the gill-laminæ below it. There are short, thick gill-rakers on the inside of the first arch, and the inner and outer sides of the other arches. There are no upper or lower pharyngeal teeth. There is a strong cardiform tooth on each side of the tongue near the tip, with a smaller, similar tooth near the œsophagus, and other teeth buried in mucous membrane along the centre of the tongue; and on the basibranchials near the tongue a broad, depressed band of asperities.

Hyodon tergisus has only four gill-rakers on the cerato-hypo- portion of the first branchial arch, similar to those described for the last fish. All the other remarks made as to pharyngeal teeth and teeth on the tongue apply equally to this fish.

Osteoglossidæ.

Osteoglossum bicirrhosum, the "Aroowana" of British Guiana, has twelve long, horny gill-rakers on the cerato-hypo- of the first branchial arch, with ten on the first epibranchial. The longest of the gill-rakers, the second to the sixth from the angle, are about twice the length of the gill-laminæ below them; for the size of the fish it has very short gill-laminæ. The inside and outside of the other arches, as also the outside of the fifth arch, all bear gill-rakers shorter than those of the first arch, and

decreasing in size as they go inwards. All the gill-rakers bear teeth. There are no pharyngeal teeth. There is a small, elongated, narrow group of villiform teeth on the upper part of the limb of the fourth epibranchial, and two moderate-sized narrow plates on the fifth arch of villiform teeth; against these the teeth on the fourth epibranchial work. A long plate of

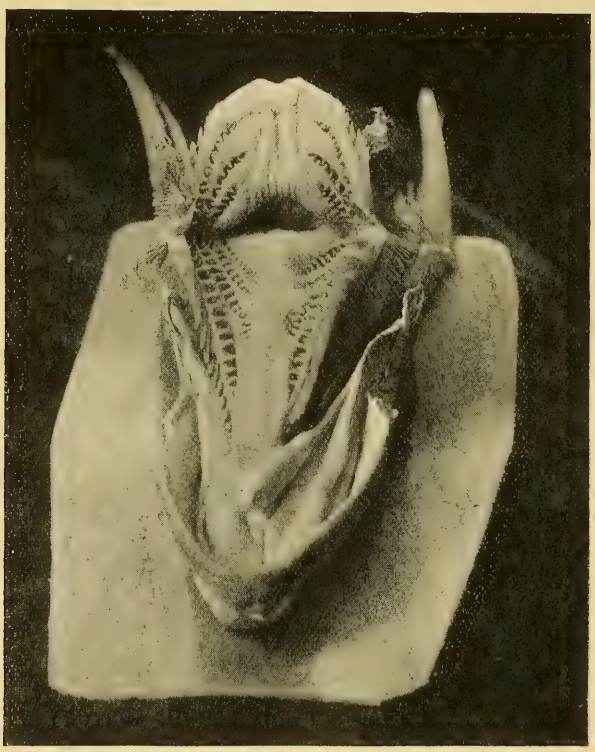

Fig. II.

Osteoglossum bicirrhosum.

teeth extends from the tongue to the junction of the third hypobranchial with the basibranchials. There is a curious leathery pouch under the forward part of the mandibles, very distensible, which makes one think of a Pelican when one looks at this fish (fig. II.).

Arapaima gigas, the Arapaima of British Guiana, and called

"Pirarucú" at Manáos on the Amazon, where it is caught in large numbers. This fish is the largest of fresh-water fishes, and said to grow to twelve feet in length; portions of one five feet nine inches in length were obtained. The basibranchials at the base of the tongue have a bony structure covered with small conical teeth set very closely together; it is eight inches in length by one and five-eighths inches in breadth in the centre. One end is rounded, the other terminates in a narrow ellipsoid shape; at this end the teeth disappear or become so minute as not to show as teeth, leaving the surface, however, very rough. This bone is used by the natives of the country where the fish is caught as a grater. On the parasphenoid, under the skull and above the "grater" bone, there is a group of similar teeth of an elongated oval shape, which is some five inches long and one and two-fifths inches wide, at its widest, of closely-set, palpable teeth, which then continue as a narrow band to the vomer. These fishes have no pharyngeal teeth, but those described above supply an efficient masticatory arrangement in their default.

Clupeidæ.

This family, to which the Herring belongs, supplies a large number of excellent fish for the table.

Clupea finta, the Twait Shad, has twenty to twenty-one long, horny gill-rakers on the cerato-hypo- of the first branchial arch; the first ten from the angle keep much of a size, and are in length equal to the depth of the gill-laminæ below them. In one specimen examined there were twelve on the right epibranchial and nine on the left one. All the gill-rakers are smooth. Pharyngeal teeth, upper and lower, are wanting. The other branchial arches carry similar long gill-rakers on their outer sides only. These long gill-rakers make a good filter for the mouth (fig. III., 2).

Clupea harengus, the Herring, has forty-two long, fine, horny gill-rakers on the cerato-hypo- of the first branchial arch; they are serrated on the inner edge. In length the longest one, near the centre of their number, is one half as long again as the gill-laminæ below it. The forty-two are contained in a length of one and three-sixteenths of an inch, so that approxi-

mately there are thirty-five to the inch. There are eleven on the first epibranchial. Long gill-rakers only grow on the upper surfaces of the first four arches; they stand up and lean across the gill-slits. Those on the first arch stand up and keep all food inside the mouth, those on the upper surfaces of the second, third, and fourth arches close the gill-slits next outside of them. The fourth gill-slit is closed by small gill-rakers growing from the inside of the fourth and outer side of the fifth branchial arches. The gill-rakers on the second, third, and fourth arches

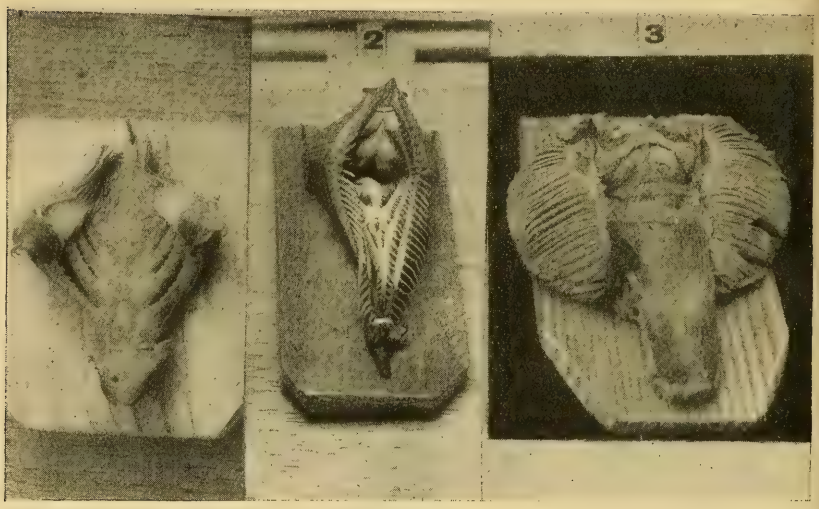

FIG. III.

POLYPTERUS SENEGALUS. CLUPEA FINTA. TETRODON RETICULARIS.

are long and fine; similar ones grow on their epibranchials. The whole forms an excellent filtering apparatus, which, considering the fine nature of the Herring's food, is essential. Here, again, reference may be made to the Fisheries Investigation cabinet in the hall of the British Museum of Natural History, where some of the minute organisms on which the Herrings subsist are displayed.

Clupea ilisha, called the "Pulla" in Scinde and the "Hilsa" at Calcutta, is much esteemed for the table. It has on the first branchial arch from the angle to the end of the hypobranchial

at least 210 long, thin, horny gill-rakers; these stand on a length of two and five-sixteenths of an inch, so average just over ninety-one to the inch; the longest one is one-half longer than the gill-lamina below it; the gill-rakers are smooth, delicate, easily broken off. They are equally thickly set along the epibranchial, which in this fish is a longer bone than usual, its length being about two-thirds that of the cerato-hypobranchial. The gill-rakers spring from the top surfaces of the branchial arches, and there is only one row of them. The gill-rakers of the other arches are of the same kind, but not so long as those on the first arch; they diminish in length as they grow on the arches nearer the centre of the mouth. The top edge of the first arch is at a higher level than that of the second, and so on, so that the cavity of the mouth resembles a deep basket. The gill-rakers of one arch fit up against the side of the next outward arch, and the whole apparatus forms a perfect filter. The fifth branchial arch, the pharyngeal bones, are devoid of teeth; and instead of lying flat at the bottom of the mouth, they are inclined to one another at an angle upwards; the object of this will be seen presently. From the surface of the first branchial arch to the floor of the mouth is a depth of about three-fourths of an inch. The epibranchials and the connected tissues form a mass, giving the general idea of the plug of a wooden lemon-squeezer; in this mass, on the middle line in front, is a deep cleft; this fits on the upstanding angle of the pharyngeal bones; the action is to squeeze the water in the buccal cavity to the right and left, forcing the water through the gill-rakers, leaving the particles of food, which are minute, in the gullet. To aid in this action there is a pronounced flange under the parasphenoid bone that reinforces the squeezing mass.

Engraulis encrasicholus, the Anchovy, has thirty thin, horny gill-rakers on the cerato-hypobranchial of the first arch, with twenty on the epibranchial.

Gymnotidæ.

Sternopygus macrurus, one of the *Gymnotidæ* from British Guiana, has five tubercle gill-rakers on the first cerato-hypobranchial arch, and one developed with two rudimentary on the first epibranchial. There are gill-rakers on the inside of the

first, both sides of the next three arches, and on the outside of the fifth arch. Those on both sides of the second and third arches are more numerous than those on the outside of the first arch. All the gill-rakers fit alternately and closely, making a good filter. There are no pharyngeal teeth, upper or lower, to be seen or felt. The mucous lining at the back of the mouth is covered with papillæ.

Eigenmannia virescens, another of the *Gymnotidæ* from British Guiana, has seven tubercle gill-rakers on the first cerato-hypobranchial, with three on the epibranchial. Under a fairly high-power microscope, hair-like bristles are seen protruding from these tubercles; they bend over at the extremity, looking like small claws. There are no pharyngeal teeth, either upper or lower, to be felt or seen. The mucous membrane at the back of the mouth is seen to have a corrugated surface when it is magnified.

Aspredinidæ.

Aspredo sicuephorus has seven upstanding but soft gill-rakers on the first cerato-hypobranchial arch, with two on the epibranchial. Similar but more numerous ones are on both sides of the second, third, and fourth arches, with shorter ones on the outside of the fifth arch. The longest of the gill-rakers is about one-third of the depth of the gill-lamina below it. A prominent ovoid pad, standing well up, of mucous membrane, is on the heads of the third and fourth epibranchials, but no teeth could be seen or felt. Neither could any be found for the lower pharyngeal teeth.

Mugilidæ.

The pharyngeal teeth described in this series of articles have always been such as could be plainly seen or felt. It is a debatable question whether the cilia-like processes on the mucous surface of the upper pharyngeal bones—for instance, in *Mugil braziliensis*—are technically teeth or bristles; as they are, however, to be seen only when highly magnified and are not palpable to the touch, the *Mugilidæ* have been put into the category of fishes not having pharyngeal teeth. The same reason caused the inclusion of the two Gymnotids above described, as also that of the *Aspredo*. The family of the *Mugilidæ* provides many excellent fish for the table.

Mugil braziliensis frequents the eastern coast of South America. The specimen examined came from Demerara, where it is called the "Queeriman." The gill-rakers are very numerous in this fish; from the top of the epibranchial to the extremity of the hypobranchial there are 146. In the centre of this length they run forty-five per inch; they are rather closer together at the extremities. They are fairly long, but are only in length one-third of the depth of the gill-laminæ below them. The gill-laminæ in this fish, however, are very long. The inner edges of the gill-rakers carry a number of minute bristles. There are numerous gill-rakers on the inner and outer faces of the other arches; they slope over to meet each other, and their extremities touch in a well-defined line. The filter formed is a very close one. The faces of the pharyngeal bones are very much curved, the lower one being curved with long gill-rakers lying all across it. The mucous membrane of the upper pharyngeal bones has, as stated before, numerous cilia-like processes that evidently would help in separating edible organisms when undergoing the triturating action that the structure of the upper and lower pharyngeal bones seems so adequately adapted to perform.

Mugil capito, the Grey Mullet, has numerous—one hundred or more—horny gill-rakers on the first cerato-hypobranchial, the longest about half the depth of the gill-laminæ below it; there are seventy-two on the first epibranchial. The inside of the first, both sides of the second, and the outside of the third arches have a number of similar but shorter gill-rakers very closely set, and these form a very efficient filter. The inside of the third and outside of the fourth have an edging of still shorter gill-rakers. The gill-rakers are very brittle; their inner edge is serrated. The upper pharyngeal bone in this, as in the rest of the *Mugilidæ*, is quite differently formed structurally from this bone in other fishes. The mucous lining of the upper pharyngeal bone is similar to that of the last described fish.

Chætodontidæ.

Heniochus macrolepidotus, from the Indian Ocean. The gullet of this fish is very small, and the gill-rakers minute. No pharyngeal teeth could be seen or felt in either upper or

lower part. The place of the upper pharyngeal teeth is occupied by ribbed mucous membrane.

Ostraciontidæ.

Ostracion gibbosus, one of the Trunk fishes, so-called from the horny, rigid case that envelopes them; this specimen came from the Indian Ocean. It has eight short, horny, upstanding gill-rakers on the outside of the first branchial arch. There are only four of these arches. On the inner side of the first arch there are twelve gill-rakers, similar to those on the outer side. The other arches bear gill-rakers, and they all form a close filter. The gill-laminæ are long for the size of the fish, and the longest of them in depth is some six times the length of the longest gill-raker. There are no pharyngeal teeth discernible, either upper or lower.

Ostracion nasus has nine short, horny, upstanding gill-rakers on the outside of the first branchial arch, with fifteen on the inner side. No pharyngeal teeth discernible.

Tetrodontidæ.

Tetrodon leopardus, one of the "Puffers" or Globe-fishes, so called from their being able to puff themselves out with air till they assume a globular appearance. This specimen came from the Indian Ocean. It has ten soft gill-rakers on the first branchial arch, seven being on the cerato-hypobranchial portion, and three on the epibranchial. The other arches have tubercles on them that stand out distinctly. There are only three gill arches in this fish on each side. There are no pharyngeal teeth. The mucous membrane of the mouth at the back is divided into three distinct sections on the site usually occupied by the pharyngeal teeth in other fishes. The upper section is covered with corrugations that run in an up-and-down direction; the other sections have minute papillæ. Nothing but lining mucous membrane is observable on the floor of the gullet.

Tetrodon reticularis, from the Indian Ocean, has thirteen soft, papillæ-like gill-rakers on the first cerato-hypobranchial, not growing in a defined row, but scattered along it; some are longer than the others. On the inner side of the first arch and on the other arches there are the same kind of gill-rakers

growing in two rows. This fish, like the last, has only three gill arches. The back of the gullet is divided into three distinct parts. In the upper part, on its outer corners, there are horny corrugations arranged more or less vertically (fig. III., 3). The two lower sections stretch as two bands across the pharynx. The floor of the gullet is covered with mucous membrane, studded with papillæ.

Gonorhynchidæ.

Gonorhynchus greyi has fifteen long horny gill-rakers on the first cerato-hypobranchial with twelve on the first epibranchial arch; the longest about $\frac{6}{7}$ of the gill-filament below it. The other arches have many similar but shorter gill-rakers that lie across the gill slits and make a very perfect filter. There are no pharyngeal teeth, upper or lower. There is a group of strong conical teeth at the root of the tongue, which engage against two plates of similar teeth on the pterygoid bones. These seem adequate to perform any function that the absent pharyngeal teeth would perform. An "uvula" like body, a lobe of mucous membrane, hangs down from the roof of the palate in front of the pterygoid plates; it is stiff, but seemingly admits of folding backwards.

NOTES AND QUERIES.

AVES.

Egyptian Nightjar (Caprimulgus ægyptius, Licht.) in Malta.—On March 14th I found at the Valletta Market a specimen of this rare bird. It was taken the day before by a sportsman from Binghisa. This is the third specimen which I have seen in the flesh; the other two were taken at Wied Zembak in the spring of 1911 by Dr. G. Cachia Zammit. Besides these, I know of nine other specimens taken in the island, three of which are in the collection of Colonel J. L. Francia, who found them, together with three other specimens, in the Market during the spring about ten or twelve years ago. Another specimen, which is unfortunately in a very bad state of preservation, is to be seen in our Natural History Museum. As with many other specimens, this bears no data; it might be, however, one of the three specimens mentioned by Giglioli in the 'Iconografia dell' Avifauna Italica,' June 11th, 1879, which, according to Dr. A. A. Caruana, were taken in the island during the spring of 1876. Very probably Dresser alludes to these three specimens when, in Part 1 of his 'Manual of Palæarctic Birds,' p. 435, he says that the species has occurred three times at Malta.—G. Despott.

Bartram's Sandpiper in Ireland.—A few years ago my cousin, the late Mr. J. S. Ellis, of Wardhouse, Co. Leitrim, asked me to examine a bird which he had shot some time previously. I recognised it as probably being a Bartram's Sandpiper, and on a further examination it proved to be certainly of this species. Mr. Ellis gave me full particulars about it. He shot it at Bunduff, Co. Leitrim, in November, 1901, as well as he could remember, in a field quite close to the sea. He showed me the exact spot, and described the curious tameness of the bird, which would suggest that it had recently arrived. When I first saw it, it was in an unfortunate condition. It had been sent to be mounted by some third-rate man, and had suffered at his hands. In addition to this, Mr. Ellis had taken it from him, on account of delay, before the work was completed, and it was still covered with the taxidermist's threads. It has since come into my possession, and everything possible has been done to preserve it, but much of the damage was irreparable. In the case of so rare a

bird it is unfortunate that it should not have been recognised and recorded at once. However, I not only had from Mr. Ellis himself a description of the circumstances in which it was taken, but afterwards it passed direct from his possession into mine. It has since been examined by Mr. Wm. Eagle Clarke, of the Royal Scottish Museum. Mr. Ellis was quite certain of the month in which he shot it, but was hardly so certain of the exact year. This makes the third occurrence of this species in Ireland, the other two also being in the autumn.—J. M. McWilliam (Craigmore, Bute).

Further Notes on Newton's Statements on Birds.—I should like to supplement my notes on some statements by Professor Newton in his 'Dictionary of Birds' ('Zoologist,' 1915, p. 182). Referring to the Stonechat, p. 918, he remarks that the cock of this species is "a conspicuous object on almost every furze-grown heath or common in the British Islands"—a statement not at all in consonance with what is now known of its status during the breeding season. In many, if not most, parts of Yorkshire, and other places in Britain which were at one time considered as eminently suitable breeding haunts for this species, it is found to be exceedingly rare if not altogether absent, as will be seen by a reference to the 'Zoologist, 1901, p. 64, and the 'Naturalist,' vols. 3 and 4, 1877–8.

With reference to the Redshank, Newton states: "Before the great changes effected by drainage in England it was a common species in many districts, but at the present day there are very few to which it can resort for the purpose of reproduction." This species, at least in some parts of Yorkshire—and there are good reasons to believe this applies to other parts of England as well—breeds much more commonly than was the case formerly, and it by no means at this season confines itself to marshy grounds; on the contrary, it often nests in dry situations at some distance from very marshy ground.

Does Newton wish it to be understood that the Lesser Redpoll is almost wholly insectivorous in summer? If so, I think he is mistaken. It may not, however, be so exclusively a seed-eating species as the Linnet, but still I think it largely feeds on seeds in summer.

The Swift, in the speed of its flight, "apparently exceeds that of any other British species," so the Professor states, a statement, I think, which it would be difficult to prove. A few years ago the late Alfred Walker, of the Bradford Scientific Society, and myself had many rambles in the Yorkshire Dales for the purpose of ascertaining the flight-speed of birds, and we found that the flight of the Swift was by no means so swift as is popularly believed. Indeed we found the flight of

many species of birds much quicker than the Swift's, which was quite a revelation to me. The flight of the Heron and Rook was much quicker, and the flight of the Swallow much slower, than I had previously thought. I am sorry that I have not at hand a table of time-flights which we took on the above occasion, but as far as I remember, the Grouse, which we timed on Barden Moor in Wharfedale, was the swiftest-flying species we noted.

An interesting feature in the economy of the Woodcock is recorded by Newton, viz. that the old birds transport their newly-hatched young, presumably to places where food is more accessible—a fact which was long doubted if not disbelieved by even eminent naturalists. Many years ago I was with the late Mr. Soppitt, of the Bradford Naturalist Society, on the banks of Windermere, and we actually saw a Woodcock carrying one of its young in the manner described by Newton; but we both believed, and had good grounds for our belief, that the parent was transporting its young not so much on account of lack of food for the young one as to put it in a place of safety.

The Wheatear does not constantly put its nest under the ground as is asserted. Indeed for a good radius from this place it nearly always builds its nest in an old wall, sometimes in the ground, but not nearly so often in the latter place as in some other districts I have visited.

Is the Starling to be considered as a late breeder, as is alleged by Newton? The most that one can say is that this species breeds somewhat later than some of our resident birds, but some Finches and Buntings are decidedly later breeders than the Starling.

In a footnote to p. 968 of the 'Dictionary of Birds,' Titmice are cited as great benefactors to horticulturists, and the accusation that they do a deal of damage to fruit-trees by destroying the buds is called wholly false. As far as the Blue Tit is concerned, with the most charitable intentions, I could not construe the behaviour of this species amongst fruit-trees and bushes as wholly of an innocuous character. The other species of Titmice I do not regard as deleterious to fruit-trees.

Referring to the distribution of the Chiff-chaff, p. 1052, the statement that this species "is very numerous in the southern and western part of England, but seems to be scarcer northward," broadly stated may be quite true, but a reference to its status in many parts of its range in England must be governed by factors other than latitude and longitude. Here, in mid north-west Yorkshire, it is

almost unknown as a breeding species, and is much commoner in some parts further east and even north.

From my limited knowledge of the nesting-habits of the Lesser Whitethroat I have always thought it affects not the thickest foliage, as Newton states, but the more open country lanes and gardens.

Speaking of the Sparrow in its economic aspect, Newton opines that if a fair investigation could be carried out the conclusion would be unfavourable to the Sparrow—a conclusion which would probably be endorsed by most ornithologists. It should, however, in fairness be stated that the Sparrow is almost exclusively insectivorous during the summer months—particularly is it passionately fond of the "daddy-long-legs," whose larvæ are so destructive to the roots of grasses. Indeed, when they are to be obtained, its young are mostly fed on these insects, and no other British bird conduces so largely to keeping them within reasonable limits.—E. P. BUTTERFIELD.

GASTROPODA.

Notes on Land Mollusca in Wiltshire in 1916.—*Feb.* 13*th.*—Fovant, near Dinton. The South Downs near here are very encouraging places to work on, mollusca being very numerous; the chalky nature of the land, I think, contributes largely to this. The most abundant species is *Helix virgata.* This species is so numerous that as one walks over the hills it is sometimes impossible to tread without crushing many individuals. Both in size and markings I find *H. virgata* varies considerably. Round the umbilicus the reddish-brown stripes are often interrupted in such a manner as to form patterns and give the shell a chequered appearance. *Helix rotundata*, *H. ericetum*, *H. aspersa*, and *H. nemoralis* (var. *hybrida*), I also found on the northern slopes of the Downs to-day; also *H. arbustorum* and *hispida*, only I am rather doubtful as to the exact identity of these two species. *Feb.* 17*th.*—As I walked down one of the lanes near Sutton Mandeville this afternoon I thought the decaying vegetation on the banks looked a likely spot, so I raked over the dead leaves in some places, and found several specimens of *Zonites glabra*, *Clausilia rugosa*, and *Vitrina pellucida.* The latter were very delicate and quite transparent, and I found considerable difficulty in removing the animals from their shells. *Feb.* 19*th.*—To-day I found a *C. rugosa* clinging to the moss on an old Roman wall on Sutton Down. *Feb.* 20*th.*—Two cast-off shells of *Cyclostoma elegans* on a bank near Teffont Ewyas. *March* 13*th.*—Deep snow has prevented any collecting this last few days; but to-day I was

again able to get out in search of shells where there was no snow. So I walked towards Sutton Down, and on the banks of a lane found several *Helix cantiana*, *H. rufescens*, and *H. virgata*, two *Bulimus obscurus*, and one *C. rugosa*. *March* 14*th*.—Collected some more specimens from the decaying vegetation on the bank of the lane near Sutton Mandeville. I found six specimens of *Helix cantiana* and one *Neritina fluviatilis*. This seems rather strange, as the nearest river is the River Nadder, flowing in the valley at least two miles away.—H. E. J. Biggs.

INFUSORIA.

Abnormal Reproduction in Stylonychia.—It is a well-known fact that in nearly all the ciliated protozoa, reproduction is effected by division into two daughter-cells, similar in size, and largely so in

Fig. 1.—×120.

Fig. 2.—×250.
A, as first seen. B, ten minutes later.

structure. Budding and spore-formation is very uncommon, and is indeed confined to a few groups. For this reason, peculiar interest necessarily attaches to any case in which gemmation can be shown to occur in a species which has been previously held not to be guilty of such a breach of the general rule; as is (to the best of my knowledge) the case with the various species of *Stylonychia*. On December 1st last I was engaged, during an interval between some experiments, in the examination of a number of *Stylonychias*, when my attention was drawn to a large individual which had attached to its posterior end the curious excrescence shown in Fig. 1. The *Stylonychia* was somewhat misshapen and unhealthy, and I naturally at first took the small organism (for such the excrescence proved to be) for a parasite. Closer examination showed, however, that the two organisms were really one. The small one, as can be seen, was pear-shaped, and consisted of granular protoplasm, similar to that of the large individual; there was also a vacuole (v, fig. 1) of con-

siderable size in the large end. Connecting the two organisms (which I shall call for convenience the "macrozooid" and "microzooid") was a band of protoplasm, which could be seen to be in actual continuity with the transparent non-granular cortical layer in both. The microzooid was clothed in short cilia, which were in brisk action; curiously enough, there was no trace of any differentiation into setæ or cirri, the arrangement being entirely holotrichous. The two organisms were kept under close observation, and in about ten minutes' time the connecting band of protoplasm was gradually lengthening and becoming narrower, the microzooid at the same time making convulsive jerks, as though to break away from its parent. In about five minutes more the process was completed; the now thread-like band parted in the middle, the ends shrivelling up, and the microzooid swam rapidly away. I kept it under observation for some time; it swam about broad end foremost, and very quickly. I did not see it ingest any food, nor alter in shape or size. In about twenty minutes after the completion of division I was obliged to leave the microscope, so I cannot say what finally became of it. The macrozooid also was alive at the end of the twenty minutes, and was seen to ingest food. For such an extraordinary method of reproduction I can give no reason. I have mentioned that the macrozooid looked unhealthy; is it possible that it was in some way diseased, and unable to effect complete division? (Here I may mention that it appears common for *Stylonychias* to break into irregular fragments, some of which may continue to live for some time, and possibly even regenerate; anterior portions are most frequently seen.)—R. D. Greenaway.

NOTICES OF NEW BOOKS, Etc.

A Veteran Naturalist. By E. W. Richardson. London: Witherby & Co. 1916. 10*s*. net.

Both the author and the publishers of this excellent biography of the late W. B. Tegetmeier may fairly claim to be considered public benefactors for putting on record the virile, upright, active life of this fine old naturalist, who died only recently, in 1912, after completing his ninety-sixth year. One of the many well-chosen and interesting illustrations depicts him as we remember him—a small-built, fragile-looking, white-haired old man, whose vivid interest in natural history

in the best sense, and friendly manner to all with whom he came into contact, were the best evidence of the genuineness and goodness of his nature. His was, indeed, a truly British character; for though, as Mr. Richardson (who is, by the way, his son-in-law) tells us, his father was a Hanoverian—in those remote days a British subject under our then comparatively new dynasty—his mother was English, and he did not even know German, or try to get his children to learn it. Eminently a practical scientist, he qualified in medicine and practised it a short time before taking to journalism, and his ornithological studies were especially concerned with such useful birds as poultry, pheasants, and homing pigeons; and as, to get practical results, a man must necessarily be scientific, it is no wonder that he was so useful to Darwin. Bees also received his attention, and he proved that the hexagonal form of the cell develops from a cylindrical one in the course of working, and is not the outcome of design. Both in journalism and outside it, he left a gap that has never been filled; and, as he was the first naturalist whose work attracted our then juvenile attention, and the one we always respected most, we have a personal pleasure in heartily welcoming this able and sympathetic book.

The Fauna of British India. Rhynchota, Vol. VI. Homoptera, Appendix. By W. L. Distant. London: Taylor & Francis. 1916.

This worthy member of a brilliant and useful series contains numerous additions in the way of new species and genera to the previous volumes on the Indian insects of this group. Some idea of the richness of the Indian region may be formed by Mr. Distant's opening paragraph: "In volume III, 149 species of Cicadidæ were enumerated and described as found in this Fauna. I am now able to add 23 more species, bringing up the total to 172." Many new forms of the extraordinary little *Membracidæ*, so conspicuous by their thoracic excrescences, are also described, of which the most remarkable are *Hypsauchenia kempi*, with its scimitar-shaped vertical horn as long as the body, and *Anchonoides typicus*, in which, besides two lateral horns, there is a central one bending over and joining the back at its tip, thus forming an actual handle—surely a unique structure among animals.

Erratum.—On p. 160, line 3, for "possessing the," *read* "possessing two."

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THE ZOOLOGIST

No. 900.—June 15th, 1916.

ORNITHOLOGICAL REPORT FOR NORFOLK (1915).

By J. H. Gurney, F.Z.S.

Owing to the war the usual number of Norfolk notes did not come to hand in 1915, many observers having gone to the front; moreover, the military restrictions on certain parts of the coast impeded the making of observations.

The Spring Migration.—April opened fine and dusty. Colonel Irby saw a Swallow on the 9th; on the 11th the Woodpecker was loudly vibrating; the Redshank was at Dunston on the 12th, and by the 13th there were Partridges' eggs at Ditchingham (W. Carr). Statistics about the emigration of birds from our shores in March are more wanted than dates of arrivals in April. Thousands of birds must quit Norfolk, or at least pass over it, about that time, but we really know exceedingly little about their movements.

For the first time the Breydon watcher's note-book does not contain a single reference to Spoonbills, but the cannon practice which has gone on in the vicinity is enough to account for their favourite tidal broad being forsaken by these annual visitants.

The Breeding Season.—Between the end of the spring migration and the beginning of the autumnal arrivals there is a period of inactivity in bird-life. For the space of ten weeks no migration goes on, if we except the departure of the Swift and the adult Cuckoo.

But this is the bird-nester's busy time, and the period when

so many life-studies in photography have been made, with great advantage to naturalists.

This year we had the presence of a Brambling in the middle of summer, seen by Mr. Vincent on June 18th, as will be mentioned presently.

The same observer detected a couple of Nyroca Ducks on July 14th, which is an exceedingly late date.

The Cormorants, which were so beautifully photographed by Miss Turner last year, again came to Lord Hastings' lake, but only on a passing visit.

The first was seen by the keeper on May 23rd, but it only stayed a short time, being probably frightened by a camp of Yeomanry in the park.

The Autumn Migration.—September was too fine for observations, besides which there were very few naturalists left to make them. When the weather is open rare birds pass over the Norfolk and Suffolk coast-line without stopping. Mist and rain, which delay them, is the collector's weather.

Each year tends to confirm the belief that migratory birds which come to the coast of Norfolk in autumn with a west wind, are delayed birds. Naturally they are much more in evidence than those which cross the North Sea at night with an east or a north-east wind. These latter come and are gone again before the naturalist has been made aware of their presence, except such portion of them as elect to make Norfolk woods and fields their halting-place.

Weather conditions being equal, different altitudes suit different migrants. Rooks, Grey Crows, and Starlings all fly pretty high, Chaffinches or any small birds, as a rule, lower, birds of prey the highest of all. The steady, purposeful, onward flight of the Starling is in great contrast to the Thrush's wavering flight. Skylarks vary, but as a rule travel very low over the sea, as may be seen from the shore at Overstrand, even adapting their course to the undulations of the waves. From 4 a.m. to 6 a.m. would be a good time to look for migrants arriving, but unfortunately by the end of September the light is insufficient for identifying small birds before six o'clock, unless they be in a line with the rising sun.

That by far the greater number of birds travel by night is

well known, and one reason for it has been supposed to be to escape the attacks of other and larger birds; but this is an altogether insufficient explanation of the matter. A far better solution of it has been assigned by Mr. W. E. Clarke, which is that the day-time is the period during which birds take their food. At night they are not accustomed to require it, and consequently their powers of abstinence are greater in the hours of darkness ('Studies in Bird Migration,' i, p. 22).

Occasionally migrants come in very tired, but for the most part they are wonderfully little exhausted, according to my experience. Crossing the North Sea would be a journey of about four hundred miles, but it is not likely that the majority start from the Dutch or German coast.

Their flight may begin several degrees further inland than that, and yet when they reach England they may be seen still going on.

Sometimes large flocks of Chaffinches, even as many as five hundred together (before they have broken up), may be seen on an oat- or barley-stubble near Cromer, in October, so close to the cliff as to suggest that they had come over during the night.

But this is less remarkable than the number of Thrushes to be flushed in that month in turnip-fields. The Song-Thrush must receive a vast accession of numbers in October and the early part of November, for in those months the well-grown fields of swedes and mangold near Cromer, and all along Norfolk's rounded coast, often swarm with them, mingled with Blackbirds and a sprinkling of Redwings.

Migration is a fascinating subject, but there are several phases of it which we have not got to the bottom of by a long way. It is a study in which speculation is easy, but facts are by no means so easy to come by, and when attained sometimes quite reverse expectation. One thing which is unaccountable is that so little should be seen, especially in Norfolk and on the east coast, of the many migratory birds on their return journey northwards and eastwards in March and April. Where are then the Thrushes and Blackbirds, of which such vast numbers were to be seen in October?

Where are the hosts of Skylarks, Redwings, Starlings, Linnets, Bramblings, and Chaffinches? There can be but three explanations. Either they are dead—or they pass over Norfolk

at night and are not seen—or they return by some other and more eastern route.

Rough-legged Buzzards.—The migration of Rough-legged Buzzards to Norfolk and Suffolk was the largest there has been for several years, and it extended to other counties. In Norfolk at least twelve were trapped or shot. It seems criminal to destroy these splendid birds, but the zeal of our game-keepers, even when they are under their masters' orders, is not to be restrained. As a matter of fact Buzzards are not active enough to catch a Partridge or a Pheasant, unless already wounded, in which case it is best destroyed.

As usual, the Rough-legged Buzzard's chief food was Rabbits, a partiality well known to Willughby. Willughby, however, did not distinguish between this species and the Common Buzzard ('Ornithology,' pp. 21, 71), nor was it until 1776 that Pennant, in an appendix to his 'British Zoology' (ii, p. 623), recognised the Rough-legged Buzzard as a distinct British species.

In the neighbourhood of Winterton, Mr. E. C. Saunders informs me these birds killed a great many Rabbits, and here they were accused by the warreners of taking Rabbits out of traps. Mr. Saunders was told that one man had found as many as four trapped bunnies thus mangled in a morning.

Two of the Buzzards were announced as early as September, five in October, and about the same number in November. Only one was reported in December; yet it seems likely that a few stragglers came over even later than this, for several occurred after Christmas, which ought to come into next year's Report.

The sexes seem to have been about equally divided. Most of these Buzzards were in immature plumage, but two of the later ones were well advanced, especially a very fine bird, with closely barred thighs, received by Mr. Gunn.

The Absence of Rarities.—The only rarities worth calling attention to were the Nyroca Ducks in April and July, a Stork in May, the Ruddy Sheld-Ducks in November (probably escaped), and Mr. Saunders' Black-breasted Dipper in the same month. Yellow-browed Warblers are recorded to have visited Suffolk and Lincolnshire and Kent, but none were noted in Norfolk.

January.

10th.—A drake Wigeon,† fourteen years old, died (E. Knight).

18th.—Nine Tufted Ducks at Hempstead (Knight).

28th.—A well-marked drake Pintail × Mallard hybrid †, shot at flight by Captain Blofeld at Hoveton, had all the appearance of being a wild bird. None had been seen before on the Broad.

February.

25th.—Merlin † and Green Sandpiper at Keswick. Bittern booming on the Broads (M. C. Bird).

27th.—A Mistletoe Thrush's nest † with two eggs at Hethel.

March.

13th.—W., 3. Grey Crows going south at Overstrand, very high (W. Burdett).

14th.—W., 2. Rooks coming over at Yarmouth in thousands, and flying due west (A. Patterson).

17th.—In a parish some four miles from the coast great flocks of Rooks were observed by Mr. Vincent to be flying south-east; also flocks of Starlings, which were coming from the east, and great numbers of Fieldfares. According to my register there was hardly any wind, but a change of temperature which next day mantled the ground with 4 inches of snow, the cause, I take it, of this movement. The snow covered the fallen acorns, and Mr. Vincent at once noticed that in consequence the Wood Pigeons were turning their attentions to Ivy-berries, on which some Jays were also feeding.

23rd.—E., 3. Many straggling groups of Grey Crows, Rooks, and Jackdaws going east over Northrepps (W. Burdett). Some people think that these birds are exclusively day-migrants; but I doubt that, partly from having found dead ones on the shore, presumed to have fallen into the sea in the night. Moreover, those which leave England in the afternoon would not arrive on the other side of the North Sea while it was still light, and must therefore make land by night.

26th.—N.W., 2. Sleet falling. At 5.45 a.m. Mr. Vincent saw a flock of Bramblings going W.N.W., and in the course of

the morning five more flocks, averaging from fifty to a hundred birds.

April.

12th.—S.E., 3. On this date a White-eyed or Nyroca drake was observed on one of the protected Broads by the head keeper, who in this instance is a very accurate observer. He remarked, as he had done on a previous occasion, that this species is fonder of the reeds than the Tufted Duck, which keeps more in the open water, an observation which we were afterwards able to confirm.

15th.—S.W., 2. In company with Dr. S. K. Long I had an opportunity of seeing the Nyroca † mentioned on the 12th, and of comparing its carriage and appearance with some Tufted Ducks, of which there were about thirty on the Broad. On the wing the Nyroca struck us both as being distinctly smaller than the Tufted Ducks; the plumage was also much redder, but the white chin-spot was not visible without a glass. This Duck was still on the Broad on the 21st, but the keeper could not see that it had a companion, and in May it finally disappeared. There was also a nice flock of eight Golden-eye Ducks † on the Broad. They seem to be fond of this Broad, for the observer before mentioned, who lives on the spot, reckoned that there were sixty at the end of March. Coots are also very plentiful here, and the same naturalist tells me that in November and December he often hears them coming in from the sea at night. For the description of a successful Coot shoot, see 'Norwich Nat. Tr.,' vii, p. 267.

[Two White-naped Cranes (*Grus leucauchen*) thought to have flown from the Duke of Bedford's park at Woburn, appeared on the Earl of Leicester's lake at Holkam.]

16th.—A Long-eared Owl's nest † on the ground at Potter-Heigham, see 'Norwich Nat. Tr.' (vol. x, p. 38), but such a situation is less uncommon than is generally supposed. In 1899 the Rev. M. C. Bird met with an instance in this same neighbourhood, and other cases might be cited. It was during this month that Mr. Bird found a Long-eared Owl breeding in an old Wood-Pigeon's nest, which I only mention because on a subsequent visit there were thirteen dead mice in the nest.

With regard to the nest at Potter-Heigham, which held five eggs, it was in a small plantation on the marsh, in a growth of brambles, which arched it over so that it was cleverly concealed.

LONG-EARED OWLS.

Its welfare was subsequently watched over by Miss E. L. Turner, who records the following dates of hatching :

April 30th.—First egg.

May 2nd.—Second egg.

May 5th.—Third egg.

The other two eggs were bad.

In the photograph of the young Owlets in their nest, done by Miss Turner, the ear-tufts can be observed already showing; indeed, they were remarked by Miss Turner when the young were two days old.

29th.—A nest † of the Little Owl at Great Melton, situated in the highest arm of a large oak, contained six eggs (G. Deacon). This was the same hole in which some schoolboys found Barn-Owl's eggs † in 1914. This year they discovered that Little

Owls were using it, but had laid so far down the hole that their eggs were hardly to be reached.

Going a few days afterwards with Dr. Deacon to investigate, we soon found the right tree, out of which the Little Owl slipped away with an undulating flight on our approach. She left behind her several pellets, which were collected, and were afterwards soaked.

They contained seven skulls of Greenfinches, or perhaps Sparrows, four small Rats, six Shrews, one Field-Mouse, and the remains of one or two Beetles.

MAY.

2nd.—N., 2. A rush of Willow-Warblers reported by Mr. C. B. Ticehurst in the north-west part of Norfolk, the country lanes around Wells and Brancaster being full of them, with a few Greater Whitethroats.

On the same day three Wood-Warblers were identified by Miss Turner in a small plantation at Whiteslea.

18th.—A Dabchick's nest on Bolwick pond. Mrs. Wathen informs me that they have nested there for some years, and are double-brooded. In due course the young were hatched, and in September the old birds were sitting again, and hatched off a second brood on the 4th (M. L. Wathen). The nest was not so large as the one you figured in 1906 ('Zool.,' p. 129), but the fabric is often bigger than a superficial examination would lead one to suppose, although very flat. The eggs, white when laid, soon become stained; they are generally invisible from the bank.

20th.—A fine adult Gannet, † which had swallowed a hook, caught off Runton (F. H. Barclay).

It did very well for a few weeks, but fish were scarce, so it was packed off to the Zoological Gardens, where, being fed partly on meat, it soon looked very miserable, and having developed mycosis, died.

During this month a Stork and an Osprey were seen by Mr. Vincent, but the dates were not put down. Sir Digby Pigott notes a Woodcock's nest with four eggs on Sculthorpe Marsh. Although this species always breeds, protection does not seem to make its nests any commoner.

June.

3rd.—A Reed-Warbler's nest † on the river at Keswick (C. J. G.), where possibly one or two breed every year. Most of the nest-building seems to be done by one bird, but it is impossible to say of which sex, as both are in attendance.

8th.—Temperature 89½° F. The hottest day registered by Mr. A. W. Preston in Norfolk, for June, in thirty-two years.

18th.—A cock Brambling seen in a small plantation near Hickling village by Mr. Vincent is an occurrence late enough to suggest breeding. We certainly have no record of one being seen so late before, but no hen was detected. It was not seen again.

July.

2nd.—A Common Linnet's nest † on the side of a house at Keswick at the unusual elevation of 21 ft. This bird has become very common here in summer. Two other pairs chose for their domicile plants of the Garden Lupin, which was going to the other extreme, but they were large plants.

14th.—Two Gadwalls and a couple of Nyroca Ducks, apparently both males, detected by Mr. Vincent on the same Broad where we saw one in April. They are believed to have only stayed two days. This seems to be the solitary record of the presence of Nyrocas in England in summer, although it is very likely they have been on the Norfolk Broads before, without being recognised.

A hundred and fifty years ago the Wigeon, Pintail, Nyroca, and Red-crested Pochard may all have been breeders in very small numbers in the wilderness of reeds and swamps, which were more extensive in Norfolk then than now, without any sportsman or reed-cutter taking note of the fact. But it is not very likely that the Scoter ever nested on our Broads.

22nd.—The contents of a Sparrow Hawk's nest, received with the nest, to-day from Essex were: 4 Blackbirds, 4 Thrushes, 5 young Pheasants, 1 Red-legged Partridge nestling, 1 Starling, 1 Hedge-Accentor, 1 Chaffinch, 1 bird doubtful. This may be compared with the dietary of one for Norfolk ('Zool.,' 1890, p. 56). It is remarkable how cleanly the Sparrow Hawk can pick a skeleton.

(To be concluded.)

A DILETTANTE IN THE CAUCASUS.

By Captain Malcolm Burr, D.Sc., F.L.S., F.Z.S.

There are few regions on the earth that offer such a variety of absorbing interest as the Caucasus. The biologist and the geologist, the meteorologist, ethnographer and geographer, the student of politics, the soldier, the mining engineer, sportsman and man of business, the artist and the mere tourist, all will find there enough to satisfy their most exorbitant demands.

The Natural History of the Caucasus has received considerable attention from a number of eminent men of science, and the general lines, and in some cases the details, of the geology, botany, and zoology are fairly well known. But the problems are so varied and so intricate that the Caucasus will remain for many years a happy hunting-ground for all inquirers.

Diversity is its greatest charm; the main range extends from the corner of the Sea of Azov in the north-west to the Caspian Sea in the east, forming a mighty barrier, spread like a curtain between Europe and Asia. This crest, with the two famous mountains of Elbruz and Kazbek, which put the Alps to shame, contains more than half-a-dozen peaks higher than Mt. Blanc. In it occur a number of interesting vertebrates, Bear and Boar, Maral Deer, four peculiar species of *Capra*, the grand "*Zubr*" or Bison, the Chamois, Wolf, Lynx, Wild Cat, and Leopard. Properly speaking, the name Caucasus is applied to this main range only, but practically and politically it covers a far wider area, with a great variety of physical features. The great corn-growing plains of the Kuban and Ter provinces on the north of the crest have much in common with the steppes of Southern Russia. Here the Saiga Antelope has not yet disappeared. To the south of the watershed, in the Transcaucasus, we have the range of the Maly Kavkaz, or Lesser Caucasus, nearly parallel to the main range, from which it is separated by the valleys of the Rion and Kura. Ararat and the

mountains of the northern part of Asia Minor belong geographically to the same district; on the east, the heights of Karabagh, and in the extreme east, south, the uplands of Talysh, where the Tiger still lingers, have a frankly Asiatic character, but form part of the Caucasus. The western portion, corresponding roughly to the government of Kutais, circuit of Batum, and Black Sea littoral, enjoys a moist and warm climate, thanks to which a most exuberant vegetation flourishes. As we go east the climate becomes drier and drier, until on the burning plains of Azerbaidjan we have a mirror of the great steppes and deserts of Central Asia.

The traveller from Europe generally arrives at Batum, but if he comes from Russia he usually leaves the train at Vladikavkaz and drives to Tiflis over the Georgian Military Road. This is one of the finest mountain drives in the world, unfortunately little visited by English travellers. It has been my good fortune to drive over this pass four times, once in August, 1912, and three times in June–July, 1915. On every occasion, unfortunately, I had no choice but to motor; it is preferable to ride, or take a carriage and travel more slowly, the better to appreciate the beauty of the scenery.

On approaching from Vladikavkaz the traveller is abruptly plunged from the plains into the narrow rift of the Terek; the calcareous rocks are thrown into a razor-edge escarpment, dipping at about 45° to the north, by the uplift of Kazbek. Crumpled and contorted shales soon replace the limestone rocks; the vertical joints give them a real saw-edge against the sky, while fluted masses of basaltic intrusions stand out boldly against the vertical walls. In the milder part of the gorge, before the stantsia of Kobi, Swallows and House-Martins flit about. I saw three Goldfinches (*shchegól* in Russian, *Carduelis carduelis carduelis* L., or *C. carduelis brevirostris*, Zarudny). But soon the traveller enters the forbidding Gorge of Darial, where it seems as though all life ceases. The naked rocks rise sheer on either side, without trees, without scrub, while the Terek roars and boils, smashing over the stones so violently that not even Trout can live in it. The effect is oppressive, and the crushing sensation was as powerful on my fourth visit as on my first. At one spot an isolated rock stands like a buttress in the

gorge. On it are perched a few ruins, attributed by tradition, like all ancient remains in the Caucasus, to the great Empress Tamara, after whom half the Georgian girls are named; they are, however, much older. The first fort was built here by the Emperor Vakhtang Gurgaslan (A.D. 446–499), and restored by David the Renewer (A.D. 1089–1125).

It is almost with relief that one emerges in the wider valley between Darial and Kazbek. Here a few Rock-Doves are always to be seen, and I caught a glimpse of one Wall-Creeper (*Tichodroma muraria*, L.). Here *Emberiza cia par*, Hartert, is first noticeably common; this Bunting (*Ovsiánka* in Russian) is numerous from Darial up to an altitude of 7000 ft. Suddenly, past a bend in the road, we reach the stantsia of Kazbek, commanding a magnificent view of the famous mountain. The peak reaches an altitude of 16,546 ft., far above the heads of his neighbours. The two glaciers of Gerget and Devdorak are not visible from the road, but are easily accessible by special excursion. The first attempt to reach the summit was undertaken by Fr. Parrot in 1811; he reached an altitude of 13,863 ft., when he was driven back by storms. In 1844 Dr. Kolenati succeeded in reaching 14,547 ft., and the peak finally was overcome by three Englishmen—Messrs. Freshfield, Tucker, and Moore—in July, 1868.

There are not a great number of birds in the neighbourhood of Kazbek. I saw one Eagle and a pair of small Hawks, which I cannot attempt to name, and a single Rock-Thrush, which was, I think, *Monticola cyaneus*, L., which is the less common species, and not the more frequent *M. saxatilis*, L. Black Redstarts are common, and the Chough (*Pyrrhocorax pyrrhocorax*, L.) plays the part of Jackdaws.

But the pride of these mountains is the *Tur*. This is the Russian name for four species of Wild Goat which are peculiar to the main range of the Caucasus. These are: *Capra cylindricornis*, Blyth (= *pallassii*, Rouiller), which ranges from Daghestan to Mt. Elbruz; *C. caucasicus*, Güld., an intermediate form occurring in the central Caucasus; *C. sewerzowi*, Menzb. (= *caucasica*, Lyd.), peculiar to the western portion of the range; and *C. dinniki*, Sat., a rare and little-known species occurring in the mountainous parts of the Kuban province. They differ

mainly in the form of the horns, which sometimes are very massive. I have seen some very fine heads in Tiflis. It is the first mentioned species which occurs in the neighbourhood of Kazbek. A keen native sportsman, Levan by name, undertook to show me some Tur in their native haunts. Accordingly we started pretty early in the morning, well laden against all contingencies. We walked some five versts down the valley, and then sat by the path and scanned the rocks above with a telescope by the hour. At length the practised eye of my companion detected a minute reddish speck in the shadow of a projecting rock, almost at the summit of the mountain called Nakherete. My eyes are pretty good, but I had to take Levan's word for it. The Tur rest all day, sleeping or dozing on inaccessible crags. Towards the evening they come down to lower altitudes to graze, returning at dawn to their rocky fastnesses. We accordingly set out to climb to meet them, with the idea of ambushing them on the descent. The climb was laborious, but glorious, up the face of the cliff; the foothold was precarious; a dense carpet of aromatic herbs made the air fragrant as our boots crushed them. The purity of the air and the wonderful scenery were ample reward for the great fatigue of the climb, which was particularly trying in the rarefied air after six months of soft town-life, especially with a rifle, bandolier, field-glasses, and knapsack. At length, about four in the afternoon, we lay *cachés* behind a minor ridge, and between the chinks of the rock my eyes were gladdened by the sight of a flock of seven Tur slowly working their way downwards. The chief was a ram of about three years, with very fair horns; there were two a little younger, and the rest were kids. They stopped to snatch a bite of sweet grass here and there, and all rested a few minutes to drink from a rivulet trickling from a patch of melting snow. The kids were frisking and gambolling as prettily as lambs, and I could scarcely bring myself to break upon their peace by pulling the trigger of the old rifle that Levan had lent me. But when they had approached to about four hundred paces, I aimed at the oldest ram and pulled. The report re-echoed through the rocks and crags around, and down the gorge, while the startled animals bolted in all directions. The bullet grazed the shoulder of the ram, but he paid no

attention to the wound, and in a moment was out of sight. These animals are extraordinarily strong, and specimens are sometimes killed carrying the scars of very severe wounds from which they have entirely recovered. Another bullet killed one of the younger males, entering at the left shoulder and flattening itself against the off hind femur. A pair of startled kids bounded up to the rock where we lay hid, and stood in astonishment at the unfamiliar creatures they saw. To Levan they represented meat, wool, and roubles, and I had some difficulty in preventing murder from being committed. The dead Tur was a heavy burden, and the return journey with the carcass down the unending talus was most exhausting, completely falsifying the old saying, "Facilis descensus Averni." The *labor* and the *opus* were worse on the way down. We were utterly unable to carry the heavy body home, and so buried it in a pile of snow by the side of the path. A few rags, used to clean the rifles, were stuck on to the body, for the scent of the powder is a perfect protection against prowling Foxes and other wild marauders. The next evening I tasted my first *shashylk* of Tur, and a more tender morsel could not be put before a king.

The wool of the Tur is extremely soft, and highly prized by the natives; I was offered a *bashlyk*, or head-dress, of Tur wool for 40 roubles, the price of a common cloth one being 2½ roubles; a few weeks later this *bashlyk* was actually sold for that price. The Tur represents clothing, food, and roubles to the ruthless mountaineers, who shoot indiscriminately, regardless of sex or season; previously, thanks to their activity and extreme wariness, the animals escaped annihilation, but the possession by the mountaineers of modern firearms is rapidly thinning their numbers. Dinnik has expressed the fear that within twenty years these beautiful and interesting creatures will be on the edge of extinction.

At the highest point of our climb after the Tur, we could hear the whistle of the "Mountain Turkey" (*Tetraogallus caucasicus*, Pall.), but though we hunted for it and eagerly scanned the rocks with a telescope, we were not lucky enough to catch sight of one.

The scenery above Kazbek past Kobi to the pass is fine; Mount Zion is particularly remarkable, terminating in a massive

bunch of needles, which make a striking outline against the sky. At every bend in the valley there is a village, or *aul*, on the projecting spur, with an old watch-tower, so that signals could be telegraphed right through the pass. At Kobi there is a *narzan*, or chalybeate spring; the water is abundant and cold, clear, ferruginous, and aerated, tasting like that of Spa. Doubtless one day there will be a *kurort* here. In June there is still plenty of snow melting in these treeless alpine slopes and meadows. Grey Crows (*Corvus cornix cornix*, *séraia voróna* in Russian), Chough (*khushitsa*), Turtle Doves, Black Redstarts (*Ruticilla ochrurus*, Gm.), are common; and *Montifringilla alpicola* (Pall.), Wagtails, Grey Shrikes, and Wheatears are also numerous. Of the latter (*Kámenka*), there are ten subspecies in the Caucasus, so I hesitate to identify them; very likely they were *Saxicola œnanthe rostrata*, Hempr. and Ehrehb., "the commonest bird in the district," according to Satunin.

Over the watershed the deep valley of the White Aragva is as fine as the Gorge of Darial, but of a different type: the descent into the valley at Mlety was very abrupt, and the southern vegetation rapidly becomes denser; the milder air on the southern slope is at once noticeable; the hillsides are covered with vegetation, and assiduously cultivated to a considerable altitude, in spite of the apparently impossible steepness. In the lower reaches the scenery is much milder; well-wooded hills replace the bold and naked crags, and the Aragva is a meeker stream than the turbulent Terek. The road by Passanaur and Ananur is particularly thickly wooded; here the local Jay, *Garrulus krynickyi*, Kal. (*sóika*), is common; Magpies, *Pica pica pica* (*soróka*), and Turtle Doves, *Turtur turtur* (*gorlinka*), are abundant; Swifts, *Cypselus apus* (*strizh*), are numerous; but I did not see *C. melba*. I saw one small Sandpiper, probably *Actitis hypoleucos*. In the gardens of every inn there is a young Bear chained up. There are two forms of the Brown Bear in the Caucusus—*Ursus arctos typicus*, L., and *U. arctos meridionalis*, Midd. According to Dinnik there is a noticeable difference in their habits, the typical form preferring the forests, rarely appearing in the alpine meadows or among the higher crags, while the smaller race in summer is often met with at great

altitudes, even up to the snow-line. The typical form sometimes occurs in the alpine meadows in the early part of the summer, but later in the season goes down to the forests to collect the ripening fruits—apples, plums, pears, and raspberries—which are grateful to his sweet tooth.

At Ananur there are the ruins of a fine old castle; it was built by the Georgian *eristav*, or governor, in 1704. Thirty-five years later there were bloody scenes here: the *eristav* of Ksan, who had some quarrel with the men of the Aragva, enlisted the help of the Lesghians, and attacked Ananur; the *eristav*—Bardzim—shut himself in, but, after an obstinate struggle, the invaders carried the day, and killed Bardzim, and exterminated his family root and branch.

Beyond Ananur the country opens out into a green and smiling hilly district, recalling parts of England. But for the glimpse of a picturesque native with a buffalo, or of a team of sixteen oxen ploughing, the traveller could imagine himself in parts of Kent or Hereford. In this district, from Ananur past Dushet to Mtskhet, Kestrels, Jays, Grey Shrikes, and Hoopoes (*udol*) are common; the only places where I saw Blackbirds were near Mlety and near Ananur; these were probably *Merula uerula aterrima*, Mad., as the typical form is said to occur only in winter. The Aragva joins the Kura at Mtskhet, the ancient capital of the Georgian tsars, and here the road turns sharply to the west, and follows the Kura to Tiflis. Along this sun-baked valley, many species of birds make use of the telegraph wires as a convenient perch; grateful ornithologists should erect a statue to their inventor. Turtle-doves are not too big to balance on this slender foothold, but the blatant Roller (*sívo-*, or *sízo-voronka*), *Coracias garrulus caucasicus*, has some difficulty in keeping his balance. Eagles, of course, cannot manage it, but I saw a pair (probably *Aquila fulva* or *A. imperialis*) effect a compromise near Passanaur, by sitting on the poles, which is much the same thing. The Bee-eater (*shchtúrka*), *Merops apiaster*, L., is particularly fond of this strategic position, which gives him a good view round for hawking passing insects, after which he springs with a singularly graceful dive; these are very elegant birds, but it is very noticeable how the brilliant coloration pales in the dazzling sunlight, so that they often

appear dull and unnoticeable. But the equally brilliant Roller is very conspicuous; his gorgeous uniform, in so big a bird, and his loud and noisy chatter like that of a magpie, render him very prominent.

Shrikes (*sorokoput*) are common. The Grey Shrike was an unfamiliar bird to me, and when I first saw him on the wing I was quite puzzled, and could not make out what this handsome fellow was, with his strikingly contrasted black and white plumage, until I saw them settle on the telegraph wires. There are five species of Grey Shrike in the Caucasus; two are winter forms, a third is a rarity, occasionally occurring in the Eastern Caucasus, and so by a process of elimination we arrive at the conclusion that the birds which are common on the Georgian Road must be *Lanius minor*, Gm. In the lower reaches of the Aragva I noticed the local form of the common Butcher-bird (*Enneoctonus collurio kobylini*, But.). The typical form occurs in the steppes of the Northern Caucacus.

The Golden Oriole is fairly common in the Transcaucasus; I heard his very cheerful and musical whistle in a garden at Dushet, and at Geok Tapa, where I saw a pair mobbing a Kestrel; their brilliant plumage is lost in the blazing sunlight. The Russians call them *Ívolga*, and are very fond of the pure liquid note; it is common in Novgorod Government, and the typical form extends from the north right through the Caucasus, where it ranges up to an altitude of 6500 ft.; it has even been known to nest at an altitude of 7000 ft. It is curious that so hardy and widely spread a bird should be so rare a visitor to our shores; it would make a very handsome addition to our list of commoner birds, but it receives the usual welcome when it does take it into its head to cross the Channel.

Kestrels are extremely common, both *Tinnunculus tinnunculus* and *Tinnunculus naumanni*, Fleischer (= *cenchris*, Bog.); the Russians call them *pustelga*, and they are practically a domestic bird in the Caucasus, being as much at home among the houses as sparrows, pigeons, or starlings. At Tiflis and at Kislovodsk they were constantly flying round the buildings and sitting preening themselves on the telephone wires; at Tiflis a pair was nesting in a gutter just over my window, and there was a fine chorus from the greedy youngsters when the parents

brought them their dinner. Below Dushet I saw a Hawk that was quite unfamiliar to me. He flew with a constant and regular flapping of his short, broad wings, until he skimmed close over the ground, at a height of only a foot or two. I could not detect his general colour nor the angle of his wings.

At Dushet I caught a glimpse of a Greenfinch (*zelenushka*), *Chloris chloris*, L., which occurs throughout the Caucasus, but is commoner near the shores of the Black Sea. There are several species of Larks (*zhavarinki*) in the valley of the Kura; the commonest were *Melanocorypha calandra*, L., and *Galerida cristata caucasica*, Tacz. At Mtskhet I saw the first Starling (*skvoréts*). The Starling is the joy of the specialist, as there are no less than nine subspecies in the Caucasus. The typical form is only a winter migrant; the Caucasian Starling occurs in the northern Caucasus and eastern Transcaucasus. Satunin's Starling occurs also in the Transcaucasus, and the Purple Starling in the West Caucasus and region of Kars; the Crimean Starling is found in the north-western part of the Kuban province. Menzbier's Starling winters in the Transcaucasus; *Sturnus vulgaris intermedius*, Praz., has been recorded from the Government of Kutais, and Jitkov's Starling is a winter visitor. Near Kobi, I caught a glimpse of *Pastor roseus*.

Near Mtskhet I saw a pair of Egyptian Vultures, *Neophron perchopterus*, L., (*sterviatnik*), sitting on the ground by the roadside, and I caught a glimpse of the Grey Vulture, *Gyps fulvus*, L., (*sip.*).

Eighteen versts from Mtskhet brings us to Tiflis. The spring of 1915 had been so unusually wet, owing to the heavy fall of late snow on the mountains to the east, that the hills round the town were still green in the middle of June, by which time, as a rule, they are burnt brown. For eight days after my arrival in Tiflis rain fell every day—usually all day; this was considered most unusual. It was a bad sign that the clouds came, not from Europe nor from the mountains on the Georgian Road, but from the wine-growing district of Kakheti, and it is a local saying that rain from Kakheti lasts many days. This is chiefly noticeable, it seems, from the fact that rain from Kakheti is a relatively rare phenomenon. It was certainly a surprise to me to see heavy clouds blowing up from the eastern steppes,

which I had always associated with a dry and burnt climate. However, when it stops it stops, which is a great advantage. I had occasion to go westwards from Tiflis, and near the shores of the Black Sea the rain is really bad; in fact, Batum, in particular, is notorious for its rainy climate, which has earned it an unenviable nickname. I had to face a lot more rain before I reached the blessed haven of a blazing sun.

Travelling in the Transcaucasus Railway was not the height of comfort, at all events, west of Tiflis. There were no sleeping-cars and no linen available; it was only by a lucky chance that room to lie down could be secured, and the heat was oppressive. It was also noticeable that stops at stations at mealtimes were limited to five minutes; the times of arrival and departure were inconvenient, and it seemed to me that this was specially arranged, with a fiendish ingenuity, with the express object of annoying me. I had occasion twice to go to Kutais, an important town, centre of a Government, and yet it is off the main line. It is necessary to change at Rion, and then spend an hour on a branch line. All trains contrive to stop at Rion at an impossible hour of the night, and about an hour is lost there waiting; so it is evident that a journey to or from Kutais involves a sleepless night. But it is worth it, as Kutais is an interesting town. Tiflis has been razed so often by numerous invaders—the last time being barely a hundred years ago, when the Persians sacked it—that few antiquities are left. The archæologist curious in Georgian antiquities comes to Kutais. Tradition associates the town with "Kites," the home of Æthus and Medea, the destination of Jason and his Argonauts. The first authentic record in history occurs in Procopius, who refers to it in connection with the Greco-Punic wars of the sixth century. According to Grazius, it was founded by the Abkhaz emperor, Levan; but probably he merely improved an existing city. In 1666 the Turks overran Imeritia, of which Kutais is the chief town, and seized all the strongholds. They destroyed the old cathedral of the Abkhaz-Kartelian emperor, Bagrat III (980–1024); but the ruins are still fine, and its carvings and ornamentation of great interest. The carvings are very numerous, in very bold relief, in a local freestone. The prevailing form of ornament is a conventional vine, with compli-

cated tendrils. A sheaf of corn is also represented; priests' headgears and twisted scrolls are numerous. All arches have rounded tops; on one big block of stone there is a curious allegorical carving, representing very vividly two beasts of prey, possibly leopards, attacking what appears to be a Roe or a Goat. The Turks were expelled in 1770 by a Russian force under Todleben, who marched into Imeritia at the petition of the king, Solomon I.

The population of Kutais is about sixty thousand, including a large number of Greeks, Jews, and Armenians, who flourish on manganese. The deposits of pyrolusite at Chanieturi and elsewhere in the neighbourhood supply half the manganese of the world, and Kutais is the focus of the business. The true natives of the district are Imeritians, a branch of the Kartelian or Georgian family; the language is a variant of Georgian. The Imeritians more readily adapt themselves to European costumes and customs than do most Caucasian tribes. They provide, *inter alia*, most of the waiters for the hotels, from Batum to Baku and Kislovodsk. They are upstanding men, often very tall, swarthy of complexion, and fine, dignified features of a distinctly Semitic type. The bashlyk is the prevailing headdress. I noticed that in Kutais, at least in summer, it is usually worn simply as a Capucine hood, which gives the wearers, with their full, broad foreheads, arched noses, and often flowing beards, the appearance of a mediæval monk, or of a prophet straight from the Old Testament. A long and shapeless, often very tattered, cherkess completes the illusion. Like all Georgians, they have a marked preference for all black costumes, perhaps because it does not show the dirt, and it is quite a relief to see an occasional dandy, even a ragged one, in a scarlet cherkess, or in one that has once been white.

The town is pleasantly situated on the bubbling, boiling Rion, as it emerges from the mountains, where, according to tradition, Promotheus was chained. This romantic and picturesque stream can be very angry at flood-times; between my two visits, in July and June, its swollen waters, turbid from the recent rains, rose with startling suddenness, threatening the three bridges, and carried away bodily a large sawmill that stood upon its banks. It issues from the mountains at the back

of the town, which rise, tier upon tier, to the mighty Elbruz himself.

A visit to Batum, a dead port while the Black Sea is closed, was too hurried to afford much material for comment beyond the fact that I was lucky enough to hit upon a really fine day. Past experience and common observation have made me familiar with the remarkable humidity of the climate of this corner of the Black Sea. When the weather is fine, Batum is a very pleasant spot, with a luxuriant and exuberant vegetation.

The district at the back of the coast between Batum and Poti is known as Guria, a little-visited country; here I spent some days on two separate occasions in June and July. The Gurians are another portion of the Georgian race; they are tall and slim, active and graceful in their movements, and the women often very handsome. I noticed several cases of a peculiar glow, like burnished copper, in the black hair both of men and women; they are very swarthy, but a few strikingly fair types are to be seen; I saw three children with very fair skins and yellow hair, yet their parents were both exceedingly dark. The men often wear a black or dark brown shirt with a sash instead of the rather clumsy cherkess; the headdress is almost invariably the bashlyk; the papakha, or high Caucasian cap, which is invariably further east, is seldom seen in Guria; the bashlyk is not often worn as a simple Capucine hood, the Gurians preferring to twist it round the head to form a turban. There is a great art in doing this, and there are several recognised methods, while every man has his own favourite way. The poorest peasant, with a few dexterous twists, will contrive to attain a most picturesque and becoming studied *négligé*. I practised for hours under a competent teacher, and eventually succeeded in managing one method in a very amateurish manner. The bashlyk is an admirable form of headdress; when twisted on turban-fashion, as in Guria and the neighbouring districts, it is the cousin of the real turban. The Turks arrange it differently from the orthodox Gurians, having it flat and tight-fitting on the head, with the tails tied in a knot at the back, while the Gurians usually have it more or less carelessly wound, with long tails protruding at a rakish angle. It is a fine protection against the

weather, and I found it a good cure for neuralgia; in the hot weather or rain it can be worn as a simple Capucine hood. In other parts of the Caucasus it is carried untwisted, hanging down the back; a brilliant colour, scarlet in particular, is much affected by the dandies, but the average man prefers black or greenish-grey. When I saw a scarlet bashlyk thus hanging down the back of the wearer, I understood for the first time the theory and pedigree of the University hood.

Life in Guria is simple; the land is largely held by big owners, and estates run into many thousands of acres, but yield small revenues, as the natives are lazy, for which undoubtedly the heavy climate is responsible. They are orthodox, but subject to some eastern influences; in one house where I visited, the women were secluded. The Adjars of the neighbouring mountains are Gurians in blood, who have accepted Islam. Food is plain and coarse; meat is poor and rare; the staple diet is hot maize-bread, exceedingly heavy, white cheese, thin wine, and every day *chakhokhbili*, or chicken stewed in a piquant sauce. A peculiar speciality of the district is *santlis*, a spirit distilled from crushed honeycomb; it is strong and not unpleasant to drink, with a marked aroma of beeswax. The aristocracy is very proud of its ancient lineage, yet very democratic, for peasants and labourers sit down to table with the prince or big landowner. It is customary for landowners to carry revolvers, sword, and *kinjal*, or long dagger; the latter is not a mere ornament, for all Georgians have the southern temperament well developed.

Guria is a hilly country but not mountainous, the greatest altitude being about 500 ft.; it consists of a series of small anticlines of Oligocene and Upper Miocene marls and soft sandstones; the latter are impregnated with oil, which is traditionally associated with the legend of Prometheus, who gave fire to mankind. These sedimentary beds are broken by a few basaltic and trachytic dykes and intrusions. The soft marls and mud become an impassable quagmire in winter, in which horses sink up to their girths, and locomotion becomes very difficult. The valleys are devoted to maize and the vine, but tea and tobacco are cultivated by the more enterprising landowners. The hills are covered with beech and dense thickets of rhododendrons, which

must be a grand sight when in flower. There is a lot of malaria; apart from the mosquitoes, the curse of the district is *Cimex lectularius.*

My host was a typical Gurian. He owned some 20,000 acres or more, but was far from rich; his house, built entirely of wood, like almost all houses in Guria, stood on rising ground which had been cleared of forest, and commanded a splendid view of the sea and the valley of the river Notanebi, beyond which the Adjar crest rose to the snow. In the distance Batum was clearly visible, and on a clear day the mountains round Trebizond can be seen. He was one of the minority who could speak Russian, and it was pleasant to sit and smoke and sip tea in the balmy, evening air, listening to the chorus of the Frogs and howling of the Jackals. It was a very peaceful scene, and seemed far from the turmoil and distress of war. As we looked over the calm waters of the Black Sea, we tried to conjure up the hideous scenes that were being enacted at its other end. We discussed the downfall of a tottering empire that had planted itself as an exotic growth on the threshold of Europe. But that empire was a mushroom upstart; the Georgian empire had existed for centuries, when the Turk first came to challenge Christendom.

After the moist and humid climate of the hilly region of Guria, surrounded by lofty mountains, it is an abrupt change to the plains of Azerbaidjan. East of Tiflis the valley of the Kura opens out into a broad steppe, extending right to the Caspian, and in the south to the plains of northern Persia—it is, in fact, a piece of Asia, and typically Asiatic. The country is dead flat; in the clear morning air the snow-clad sierra of Daghestan is visible in the north, and the rounded heights of Karabagh in the south. Otherwise the only break in the horizon is a series of low, escarped hills, running east and west between Nukha and Evlakh, called Boz Dagh, or the Grey Mountain. In every direction, as far as the eye can reach, unending plains fading away on the horizon, broken by an occasional clump of trees or mosquito tower. The soil is a fine, grey clay, from which the waves of the Caspian have receded only in quite recent times; in places there are expanses of saltings, but where irrigation has been carried out by the natives, the fertile

soil gives abundant crops of vine and rice, and cotton has recently been tried with some success. The inhabitants are almost exclusively Azerbaidjan Turkis, usually referred to as Tartars; their language is of the same group as Ottoman Turkish, but little affected by Arabic influence, though the Persian effect is greater; its simple and straightforward structure has made it the *lingua franca* of the Eastern Caucasus. These Tartars are industrious, patient, grave, and polite, and are generally respected.

My destination was Geok Tapa, the estate of the only Christian landowner in the neighbourhood; the place has been described by me in the 'Entomologist's Record,' xxv, pp. 12 and 37, 1913. My host, Alexander Borisovich Shelkovnikov, has devoted the past twenty years or more to collecting and observing, with a view to monographing the biology of his district of Aresh. He has accumulated an enormous quantity of material, and is constantly pouring fresh matter into the Caucasus Museum at Tiflis; and there is hardly a museum in Europe where labels, "Dist. Aresh. Geok Tapa. Shelkovnikov," are not familiar. The flora and some branches of Entomology have received special attention. The former is illustrated by a *hortus siccus*, which is now in the Tiflis Museum, where also is his collection of Coleoptera; the Orthoptera have been partially worked by myself, and almost every group has received serious attention from various specialists. Yet the fauna is so rich that new things are constantly turning up, even among the better-worked branches. Alexander Borisovich himself is constantly collecting and despatching large masses of material, and with true Russian and eastern hospitality, welcomes all naturalists to his hospitable roof. On this visit I was lucky enough to find my old friend, V. Bianki, with his three sons; this is sufficient guarantee for the Ornithology of Geok Tapa.

In the garden and park alone the fauna is rich. The common birds are the Bee-eater (*Merops apiaster*, L.); (*M. persicus* occurs, but I did not see it); Hoopoe, Golden Oriole, Krynick's Jay, Swallow, House-Martin, Roller, Kestrel, Turtle-Dove, Green Woodpecker (*Gecinus viridis saundersi*, Tacz.), House-Sparrow, the Caucasian race with paler cheeks, (*Passer domesticus caucasicus*, Bogd.; in Russian, *Vorobéi*). The Kingfisher

(*zimorodok*) nests in the banks of a little irrigating canal a few yards from the house. But the *specialité de la maison* is the *túrach*, or Francolin (*Francolinus orientalis caucasicus*, But.), a race peculiar to these plains. His chuckling whistle resounded all day in the fields round the house. I occasionally flushed one on the steppe. It rises like a Partridge, but, being big and rather heavy on the wing, is of more importance to the cook than to the sportsman. The flesh is white and tender, recalling that of the Guinea-Fowl, but not so dry.

Over the steppes, birds of prey are common. Besides the Kestrels, which are very numerous, *Aquila melanætus*, L. (= *imperialis*, Bogd.) is quite common. The Black Kite (*kórshun*) (*Milvus ater*, Bogd.) flew over us on one occasion. I saw one Harrier (*lun*), which I think was *Circus cyaneus*, L., which occurs throughout the Caucasus up to an altitude of 9000 ft. But on the desert, where there is no irrigation, the few spring torrents rapidly dry up, and from the early summer the ground is a real desert. In the distance it has a bluish-grey colour, due to the quantities of isolated stalks of the glaucous grass of the steppe, *Artemisia maritima*. At the beginning of July this plant is already burnt dry. The tops are often crowded with what looks at first like a mass of white flowers, but is really a quantity of a small Snail (*Hedix derbende*) bleached by the sun. There is little other vegetation. Thanks to its long roots, the delicate *Alhagi camelorum* can exist at some distance from the canals, and retains its freshness even into the autumn. *Prosopis stephaniana* has fluffy, pinkish flowers in July; in September its pods burst and expose a crimson interior, lending a pleasing touch of colour to the scene. The long, sprawling stalks of *Capparis spinosa* are dotted over the steppe and keep their green colour into the autumn. In places there are patches of the alkaline *Salsola soda* and *S. kalia*, whose juicy shoots offer food and refreshment to a number of interesting Orthoptera.

The desert is alive with insects in July. The steppe Orthoptera, a noisy Cicada, an occasional *Palpares* and *Ascalaphus*, and a number of enterprising Odonata are enough to keep the collector busy for a long time; but in Ornithology there is little to do. As V. Bianki remarked, after we had walked for some hours, it is almost lifeless. *Galerida cristata*

is the only small bird. An occasional Hawk, Eagle, or Vulture flies overhead, and on one occasion the Little Bustard (*strépet*), *Tetrax tetrax*, passed over.

Through the hills of Boz Dagh there is a gorge called Oghrudzhe—an ideal spot for a picnic. The inner man was thoroughly attended to, for our conveyance over the desert—a *furgon*, or heavy waggon drawn by oxen—was laden with provisions and luggage enough to satisfy a sybarite. A mass of freshly-cut grass, green and juicy, afforded fodder for oxen and cushion for man, when duly covered with Persian rugs. A black lamb sat patiently in the waggon, and was caressed by us on the road and eaten on arrival, which seemed rather cannibalistic; he promptly fulfilled his destiny, was despatched and skinned by the Tartar servants, and carefully carved by our host. A juniper and a pistacio gave fuel for a blazing fire, over the glowing ashes of which we roasted on skewers the most tasty shashlyk from our comrade the lamb, tomatoes, and *bakladjan*, or aubergine—inevitable accompaniment of an Eastern meal. Wine, both white and red, a samovar, and even vodka had not been forgotten. The place is absolutely waterless, so an abundant supply was brought in huge jars of classical design.

This epicurean feast did not interfere with field-work. We heard, but did not see, the Rock Partridge (*Caccabis chukar*, Gray), a very characteristic member of the avifauna. On a crest of the hills eleven Vultures sat in state, launching themselves with dignity into the air as we approached. There were no less than three species among them, all of which occur throughout the Caucasus: *Neophron perchopterus*, L., easily recognised from below by the sharp contrasts of black and white; *Gyps fulvus*, Gm. (*bielogolovy sip*), which appears dull grey; and *Vultur monachus*, L. (*chorny grif*), which seems almost black. The only other bird of prey noticed was *Circætus gallicus*, Gm., which the Russians call the Snake-eating Eagle (*oriol zmeyad*). The sharply-bent angle of the wings is very characteristic. We observed a few Goldfinches (*Carduelis carduelis brevirostris*, Zarudny), and under a thorny shrub found the nest, with eggs, of *Aëdon familiaris*, Men. This was on June 28th–July 11th, which seems very late, especially in this hot climate, for fresh

eggs. This species occurs throughout the Eastern Transcaucasus and the shores of the Caspian. A young Roller was found in a hole, with the first feathers just beginning to appear. It is odd that such brilliantly-coloured birds as the Roller and Bee-eater should nest in holes. I noticed a Bee-eater fly direct into a hole to his nest in a hole in a mud-bank by the roadside.

The hills of Boz Dagh attain no great altitude, but their wildness and the desolation of the scene give the impression of true mountain scenery; vertical cliffs, carved boldly into ravines and gorges almost barren of vegetation, have the effect of a wild and desolate mountain-range in miniature. In the gorge itself there is a tolerably rich flora. There are three species of Juniper, *Juniperus oxycedrus*, *J. fœtidissima*, and *J. isophyllus*; other characteristic plants are *Pistacia mutica*, *Ephædra procera*, *Rhus cotinus*, *Prunus microcarpus*, *Paliurus australis*, and some of our old acquaintances from the steppe occur here, too, as *Prosopis stephaniana*, *Capparis spinosa*, which develops an agreeable smell in the evening, *Alhagi camelorum* and *Artemisia maritima*; the feathery, mauve flowers of the Tamarisk are much in evidence; *Reaumuria* is a pretty little mauve flower, with glaucous stem and leaves. The structure of the hills is clearly visible from the crest of the highest escarpment, which is only about 200 metres above the sea. There is a series of undulating escarpments, striking about north-east and south-west, with a gentle dip, culminating in the range of hills in question, the well-named Boz Dagh, or Grey Mountain.

The dry, grey rocks look like a good home for reptiles, but they are not numerous; I saw one *Agama caucasica*, Eichw., a good-sized, grey Lizard that frequents these hills. There are a dozen species of Snake known in the neighbourhood, but they do not seem to be very much in evidence. Under the balcony of the house was captured a *Tarbophis ibera* (= *vivax*), a typical Caucasian snake; his venomous properties are not definitely known, but he is regarded with suspicion; he certainly has a poisonous appearance; he is fond of getting into the roofs of houses to hunt for small birds. The Tartars call him *Dam ilam*. The only undoubtedly venomous snake in the Aresh district is the ponderous *Vipera lebetina*, L. This is by no means rare in the dry steppe, where it feeds on Gerbilles, Hares, and small

birds; it attains a length of 1420 mm. and a diameter of 60 mm. Its bite is usually followed by fatal consequences; cattle are often bitten by these vipers and usually die, but the Tartars sometimes succeed in averting fatal results by applying promptly a wet cup above the wound. Owing to its heavy build, *V. lebetina* is a sluggish creature; if held firmly by the tail at arm's length, it is unable to raise its heavy body, and so may be picked up boldly and dropped into a bag or collecting-box.

Several Lizards occur, as *Ophiosaurus apus*, Pall., *Lacerta viridis*, L., var. *strigata*, Eichw., *L. saxicola* var. *gracilis*, Mich., *Ophiops elegans*, Menk. Tortoises are numerous; the commonest is the ordinary Land-tortoise of the Caucasus, *Testudo ibera*, Pall. *Clemmys caspica*, Gm. is very common along the banks of the canals, but *Emys orbicularis*, L., is rarer; the young Tortoises are attacked by Storks and Vultures.

I saw few mammals; a dead Weasel on the road and an occasional Hare, *Lepus cyrensis*, Sat., on the steppe, complete my list of wild mammals observed in the district, but several interesting forms occur. The Striped Hyæna is a great rarity in the Aresh district, and the Gazelle (Russian and Tartan, *ajeiran; Gazella subgutturosa*, Guld.) has retired further to the east and south. Forms peculiar to the Kuro-Araksin valley, according to Satunin, are as follows: *Hemiechinus calligoni* var. *brachyotis*, Sat., *Cerbillus hurricanæ*, Jerd., *Mus muiculus* var. *tartaricus*, Sat., *Nesocricetus brandti*, Nanr., *Alactaga williamsi* var. *Schmidti*, Sat., and *A. elater* var. *caucasicua*, Nanr.

On June 16th–July 31st I very unwillingly left my genial host for Baku, where I had no time for Natural History. There I sweltered for two days. There is a magnificent municipal bathing-place, but the sight of interference-colours on the surface of the water, due to a film of oil and various objectionable objects from the town, were very discouraging. So I took a boat and rowed right out to sea, and had a glorious swim, comforting myself with the thought that here at least was a sea in which *Navis submarina* is not a member of the fauna. As the temperature was over 100° F. in the shade it was a good place to get away from, especially as there was a moist, hot wind blowing up from the south; it seems curious that though the hills round Baku are bare and treeless, the climate is quite

moist, and the heat consequently disagreeable. In the desert of Boz, where there is no humidity, the scorching heat of a blazing noonday sun, in spite of the total absence of shade, does not prevent the air from being crisp and even invigorating. An exceedingly high temperature produces no disagreeable effect, providing the actual skin is not scorched, which may cause great pain. I was able to undergo considerable and prolonged exertion without the slightest discomfort, but the difference was very marked on returning home; directly the canal-zone was reached, with vegetation, though the temperature was no higher, considerable discomfort was caused, and a profuse perspiration broke out instantly.

The journey along the banks of the Caspian as far as Petrovsk is not without charm and interest. The scorching heat of the grey terraces between the mountains and the sea, infested by *Anopheles* and *Culex*, make it a bad place to live in; officials and their families at the stations along the line lay gasping in the shade of a hut or umbrella, unable to undertake the slightest exertion before the evening. And yet the conscientious Tartars strictly carry out their law, and during the fast of Ramazan, not a glass of water nor a cigarette touches their lips so long as the sun is above the horizon. For miles no trees, grey hills, a flat, grey terrace, *Alhagi*, *Salsola*, *Artemisia*, and the unceasing shrill of the Cicadas. The famous wall of Derbend is clearly seen from the train; it runs from the ancient fort on top of the hill down to the sea, embracing the town within its two arms. The walls are about eight or nine feet thick; the composition is stones and brick, faced with blocks of smooth stone about two feet square. The irresistible Peter the Great visited Derbend, coming by sea from Astrakhan, and suggested carrying this wall from the Caspian to the Black Sea, to shut off the raids of the wild tribes of the Caucasus, but the undertaking was too vast even for his colossal abilities. Derbend is mainly a Tartar town, but there are a number of Jews and Armenians, and a sprinkling of the wild highlanders from Daghestan may usually be seen stalking down the streets. The country here assumes a greener aspect, and is intensely cultivated by the patient Tartars, who are fine gardeners, and eke out a permanent sustenance from a tiny plot of land. Sturgeon-fishing is the main local industry.

At Petrovsk the line leaves the sea, turning abruptly to the west; this town owes its importance to the fact that it is the most northerly Caspian port which does not freeze in winter.

The early morning air presents a splendid panorama to the traveller by rail as he approaches Mineralnya Vody from the east; the jagged snow clad crest extends right across the sky-line, like the Pyrenees as seen from Pau, but more than half as high again. The mighty Elbruz himself, standing head and shoulders over his neighbours, reaches a height of almost 19,000 ft.; the snow on his flanks is spotless and smooth, and his profile, seen from the train, shows up clearly his twin peaks and the concave flanks. Mineralnya Vody is a station, a junction, and nothing else; most travellers associate it with a a change of trains, a meal in the open, and illustrated post-cards—it is, in fact, the threshold of the Caucasus. Its *raison d'être* is the fact that it is the junction for the Group—that is to say, the series of watering-places which nestle in an outlier of the mountain range. These watering-places are famous all over Russia, and they deserve to be known far over her frontiers. Kislovodsk ("Sour Waters") is a charming place, and is certainly the queen of Russian resorts; it is well planned and well built, with excellent restaurants, theatres, music, and shops. The place where the health-seekers drink the waters is a fine colonnade, where all sorts and conditions walk about, sucking chalybeate waters through a bent glass tube, just as they do at Spa. The chief town of the Group is Piatigorsk, the Five Mountains, with memories of Lermotoff; another is Essentuki, whose table-waters are drunk all over Russia; less known are Zheleznovodsk ("Iron Waters"), a charming little spot, and Beshtau, which is the Tartar form of Piatigorsk. After thirty-six hours in the train from Moscow, the weary traveller is glad to get out and stretch his legs at Mineralnya Vody, and takes his breakfast in the cool morning air; but after an hour or two, he is equally glad to leave it, whether it be for the shady towns of the Group nestling in their mountain valleys, or for a few more hot hours in the train, to Vladikavkaz and the Georgian Road.

NOTES AND QUERIES.

MAMMALIA.

Present Status of the Squirrel in Britain.—Could any of the readers of the 'Zoologist' give me information regarding the present sta s of the Squirrel population in different parts of the country? I should like to know whether it is stationary, on the decrease, or on the increase, and if the latter, when was the increase first noticeable? I should also be glad to know if any signs of disease have been observed. Here (Shropshire) Squirrels are now plentiful, after being scarce for several years.—(Miss) Frances Pitt (The Albynes, Bridgnorth).

Inherited Variation in Cat.—I wish to bring to your notice a somewhat curious instance of variation in a domestic Cat which I observed in Sussex this month. The cat in question, which was a female of the familiar tabby-and-white variety, had an extra toe placed on the inside of each fore-foot, so that it had five toes on each of these feet as well as the usual claw half-way between the toes and wrist, or if this is counted, six toes. The extra toe on each foot was separate, and joined to the rest of the foot by a piece of skin, and had a remarkable resemblance to the thumb of a Platyrrhine Monkey, as it was turned outwards, but was, naturally, not opposable. Each of the extra toes had a perfectly developed retractile claw. The owners of the cat tell me that it has had kittens which also exhibit this peculiarity, but such kittens are also always exactly like the mother in colour and markings. Kittens of any other colour or entirely "tabby" are without the variation in the fore-feet.—N. O. R. Serjeant (Great Wakering, Essex).

AVES.

Black-bellied Sand Grouse (Pterocles arenarius, L.) in Malta.—A female specimen of this species was taken at Gozo in the limits of Nadur on April 11th. It was sent to my brother, who stuffed it while I was out in the country. This is the second specimen taken in these islands, and so it will probably be the fourth to be included in the list of Italian birds. In Giglioli's list of 1907 only two individuals are mentioned, and these were taken in Nice on December 2nd and 16th, 1896, the same being also reported in Count Arrigoni's list of 1913. The first specimen taken in these islands is the one mentioned in my 'List of the Birds of Malta' of 1915; it is a male in full plumage. According to the data kindly furnished to me

by my friend Dr. Giovanni Gulia, this specimen was taken at Gozo in the limits of Kercem. Dr. Gulia examined it in the flesh before it was sent for stuffing to the late Mr. Micallef of Birchircara by its owner, Mr. A. Saliba, of Gozo.—G. Despott (Malta).

White Storks (Ciconia alba, Bechst.) in Malta.—Some White Storks passed over the island during the morning of May 10th, two of which were shot in the vicinity of Birzebbuggia. My brothers, who were at the time in that locality, reported to me the occurrence, saying that they saw the birds coming over from the south-west, and that one of the birds, which they had ample time to examine in the flesh, was an immature specimen. The White Stork being a very rare straggler to these islands, I think its occurrence is quite worth recording. Schembri, in his 'Cat. Orn. del Gruppo di Malta,' says that the species is rather rare, and that he saw a specimen for the first time in Malta in April, 1840. Wright, in his 'List of the Birds of Malta,' says that the species is rare and does not occur annually; he also mentions three specimens, one of which was shot on March 22nd, 1857, and the other two on May 4th and 7th, 1863; these last two, he says, were sent to him by Capt. Carr, R.A. I have never seen the species in Malta, either alive or in the flesh; I know, however, of two stuffed specimens, one of which was in the possession of Mr. L. Naudi, Pharmaceutical Chemist at Rabato, the other is in the Malta Natural History Museum, though this bears no data; from the style of its mounting, I am inclined to think it is one of the specimens which were in the collection of Wright.—G. Despott (Malta).

Notes on the Laying of the Cuckoo.—An interesting occurrence of the laying of the Cuckoo, and one that without the complete facts would have further supported Mr. E. P. Butterfield's instances of the Cuckoo laying in an empty nest ('Zool.,' p. 153) recently came under my observation. Whilst I was staying at a farm at Turvey, in Bedfordshire, on May 7th last, some of the children of the farm-hands robbed a nest of a Hedge-Sparrow of its three eggs at 2 p.m. The laying of these had taken place on the consecutive mornings previously. At 6 p.m. these children had the curiosity to visit the nest again, and then found the egg of a Cuckoo had subsequently been deposited in the empty nest. The conclusions I draw are that the Cuckoo had located this nest when it contained eggs, and on bringing its own to deposit therein had practically no alternative but to leave it there, whether to be eventually removed it is now impossible to say. Instances such as this may be frequent, and do not affect the point of my query (see

'Zoologist,' p. 317, 1915) as to whether the Cuckoo ever deposits its egg in a nest before the first egg of the foster-parents' clutch has actually been laid therein.—J. STEELE ELLIOTT.

Gulls in Bedfordshire.—One would think this county too remote from the sea for very frequent observations on any of the Gull family, but yet they occur by no means uncommonly, and evidently in increasing numbers; hence I desire to put on record their present-day status in this locality. The Great Black-backed Gull (*Larus marinus*) is certainly a rarity, and I think it has been almost invariably obtained in immature plumage; these birds are probably always storm-driven visitors. Four instances are recorded in the 'Victorian History of Bedfordshire' (p. 134), and another was killed at Wootton, February 27th, 1905. The Lesser Black-backed Gull (*L. fuscus*) and Herring Gull (*L. argentatus*) are commonly observed, more particularly during their migratory flights in April and May and again in September and October. They are then generally seen in small parties. There is evidently a well-used flight-line running S.W. to N.E. across the county. The two species seem to occur in about equal numbers. The Kittiwake (*Rissa tridactyla*) only occurs when forced inland by stress of stormy weather, and so is practically restricted to the winter months. Those seen are usually solitary birds, and are frequently in a very exhausted condition. The Common Gull (*Larus canus*) was once considered one of the rarer Gulls visiting this county, and the record was more particularly of solitary birds occurring during the winter months. But in February, 1912, several hundreds appeared together at Newnham, and remained for several days ('Zool.,' 1912, p. 232), and another considerable migration is recorded under the next species. The Black-headed Gull (*Larus ridibundus*) has always been a very frequent visitor both in winter and on migration, so much so that it was formerly known as the "Cordy Mordy," although no doubt other Gulls came under the same name. In the spring small flocks remain for a week or more at a time, and often vary in number from day to day. By far the largest flock that I have ever seen or heard of occurred during the present Spring, along with large numbers of Common Gulls. Several Black-headed Gulls were to be seen at Newnham from March 13th to 17th, and on March 15th and following day about 200 Gulls were reported to me on the fields alongside the River Ivel at Blunham, some seven miles distant. On March 26th my son and I counted 275 Gulls together on the River Ouse meadows at Fenlake, and there were probably over 300 in all scattered about the meadows between there

and the village of Goldington. About three-fourths of this number were Black-headed Gulls and the remainder Common Gulls. There were many of both species in full breeding-plumage. I am informed numbers of Gulls were seen in this latter locality a week previously. On April 2nd, my son tells me, only about a dozen were to be seen, but a few have been observed since this date and up to April 18th, though possibly all were more recent arrivals.—J. Steele Elliott.

Breeding-Habits of the Linnet.—How different species of birds may have different habits in their distributional range is well illustrated in the paper on 'Breeding Birds of Malta,' by Mr. Despott, in the 'Zoologist' (p. 171). In Malta, he remarks, under the head of Linnet (*Linota cannabina*, Linn.), that both male and female take part in the construction of nests. In this district I have ample proof that only the female takes part in the building of the nest. The male always accompanies the female when the latter is searching for building material, and remains near the nest uttering short snatches of song whilst the female is engaged in building operations. Indeed, during nearly the whole of the nesting-period the male and female are always together, except when the female is sitting and has young nestlings. From the date of nesting-period given by Mr. Despott, I infer that this species is single-brooded in Malta. In this district a good many are certainly double-brooded, the breeding-period extending to late July and August.—E. P. Butterfield (Wilsden, Bradford).

A Much-used Nest.—The other day I came across an old Blackbird's nest built against the bole of a tree in Bingley Wood, the bottom part of which, it was evident, had been utilised as a winter resort of the Wren, whilst on the top of the whole structure, which had been much disarranged on account of the burrowing of the Wrens, the nest of a Chaffinch was built.—E. P. Butterfield.

A Closely-sitting Missel Thrush.—The other day I found the nest of a Missel Thrush in the wood a short distance from this place, built on the lateral branch of an oak near its extremity, and on trying to flush the bird from its nest I had the greatest difficulty in doing so. I came at last to think the bird was dead, owing to the late cold weather we had. A friend was with me at the time, and he was determined to settle the matter. He fetched a long stick and lifted the parent's hind-quarters some little distance from the nest; still it would not leave the nest, and before it did so he had to strike the

branch quite violently. Such behaviour in this species is not usual.
E. P. Butterfield.

Further Notes on Newton's Statements on Birds.—I am somewhat interested in Mr. E. P. Butterfield's remarks ('Zool.,' 1916, p. 196). There can be no doubt of quite considerable differences between the observations of field-naturalists made during recent years and those made even a very few years ago. And, with equal certainty, the changes observed, as regards distribution and dispersal, become more and more marked in the course of one man's life, and of the time he may have devoted to the observing of such phenomena. But whilst these very marked differences scarcely warrant critical remarks regarding the accuracy of previous recorders, they often do add very considerably to the current interest of the studies in Ornithology, as they also do in most studies of other branches of natural history inquiry.

Distribution and dispersal, extension or compression, increase or decrease, development or contraction are all subjects—it is almost needless to insist—which are intimately connected; and most surely have a distinct bearing as a whole upon other phenomena, such as migration, food-supplies, changes in temperature, character of the seasons year by year, and even in the habits of species. These act and interact in their courses, and become more and more differentiated the longer the time of careful records is extended. But the results garding the past and present periods in the life-history of a species must be limited to absolute knowledge and records in the past, and the ability and continuous day-by-day, month-by-month, year-by-year observing and recording in the present, of students of these subjects. Yet the whole lifetime of one observer, however capable and however devoted, is quite insufficient to enable him to arrive at finality. To attempt prophesying a future expansion or restriction may require the whole lifetime of a whole generation of accurate recorders—even in some single quite limited area—at least as regards many or most of our very commonest species. And if the larger areas be considered, how vastly greater must be the numbers of accurate observers and recorders required to arrive at any finality! These recorders must be situated in all parts of the world, occupying every conceivable kind of locality, and their records kept with strictest continuity. Even then perfection could scarcely be arrived at, or prophecy ever approach it. And, after all, these are the very points which add to the interest of study—something gained, but much

more accuracy still required. It is therefore quite of interest to compare such accounts as those given by Mr. Butterfield from one locality or district with those gathered together for a wider area, or with those from another locality or district. Thus, in the case of the Stonechat, it is a bird which we in Scotland may well designate "not uncommon but locally dispersed, varying greatly in numbers east and west, north and south, and nowhere what could be called *very* abundant save in a few favoured localities," in, say, A.D. 1900. (But what it may be, say, ten, twenty, thirty or more years later, it is not so easy to say!) Changes such as those described by Newton in the numbers of the Redshank and those spoken of by Mr. Butterfield in Yorkshire are no doubt both equally correct. Indeed, we know of quite a number of exactly similar facts as regards this bird which have come under our own personal observation. For instance, the almost complete disappearance of Redshanks from quite an extensive district which in my own remembrance and record was thickly populated by nesting pairs prior to 1863, and the subsequent occupation of the same extensive area by the Greenshank, which first began to take up nesting places there only a few years later—there were none certainly there prior to 1865 or thereby—is one remarkable illustration. And on my own property here the Redshanks nest to the extent, in some seasons, of at least four or five pairs, where none had ever been present in my whole school-boy nesting days, though the ground was perfectly suitable to all appearances, and though they bred commonly a few miles off. As regards the dispersal of the Greenshank, the tendency hitherto has been—within my own knowledge—to move from north to south and north-west to south-east, and, after an interval, from west to east. These and other similar dispersals are the points of interest so far as my own continuous observations have enabled me to judge, assisted by the records of other observers in the past. It may yet prove of greater interest when (if ever) the endeavours may be crowned by a very much longer series of facts accumulated from present times onward; and when *all* have been compared, tabulated, and analysed, some naturalist of the future or some far-seeing historian of to-day may be able to arrive at other abler conclusions, opening up and explaining much of the past, and throwing a certain amount of prophetic light upon the future. Some of the mysteries may be cleared up by long-continued observations and careful records of many lifetimes of generations of observers who are able to pay attention to all the conditions involved, such as those of degrees of temperature and

physical changes; latitude and longitude of areas previously occupied as compared with to-day and "to-morrow"; elevation, aspects; exposures to morning, noon, and evening sunshine or shade; and all the influences brought to bear upon plant and insect life. It may be acknowledged that such a statement as that quoted by Mr. Butterfield from 'Newton's Dictionary' (p. 1052) and Mr. Butterfield's own local observations in Yorkshire are equally correct. But even if so, the two items are apart, Newton's being "broadly stated" for all England, and Mr. Butterfield's being, as he himself tells us, confined to "mid North-West Yorkshire," and therefore of local application only and due to *other factors besides latitude and longitude.* The complete 'Dictionary' would have been extended to many thousands of pages had room been given to expand into details of local records and their accompanying phenomena.—J. A. Harvie Brown.

Black Redstart Nesting near Windsor.—I am writing (somewhat late in the day) to place on record the discovery of a Black Redstart's nest near Windsor, Bucks., in 1915. The nest was found by someone else, who did not study birds but only collected eggs, and hence he did not observe the birds. There were six eggs in the nest. He took three, giving one to me. The next day I went to the nest. It was in a tin in a rubbish-heap in the middle of a field. The nest was made very roughly of hay, lined with a few feathers. On arriving I found a Toad had taken possession of the nest, and all the remaining eggs were broken. Both birds were near by, and I am absolutely certain of their identity. I have looked out for them this year, but they have not arrived. The finder's name was G. N. Collins, and the date of discovery was June 3rd, 1915.—N. Orde Powlett.

CRUSTACEA.

Educability of Galathea strigosa.—(1) On November 20th a fine large specimen of *Galathea strigosa*, from Weymouth, was placed in an aquarium. During its life in the tank, which lasted exactly a hundred days, it ate pieces of Plaice, Goby, *Portunus marmoreus*, *Eupagurus pubescens*, Shrimp, Æsop Prawn, Mussel, and beef. The stages in its progress towards tameness were very interesting. Until the eleventh day of captivity it refused to eat anything, and clung motionless upside-down to the roof of a shallow hole in the rocks, showing extreme nervousness and crouching against the rock on the approach of the feeding-forceps, or of one of the two Common Spider-Crabs which shared its tank, and even when food was dropped close to its head. It used its long chelæ with a thrusting, rarely

with a snapping, action to drive back the Spider-Crabs or forceps. On the eleventh day, after hesitating for several minutes, it slowly and cautiously conveyed to its mouth some pieces of mussel which had been gently placed in its chelæ. It was not until the forty-first day that it had become tame enough to reach forward with its chelæ to take mussel from the forceps. On the forty-fourth day it not only reached eagerly forward for the food, but came partly out of its hole to take it; and it began to eat without allowing a few minutes to elapse, which it had never done before. Its fearlessness of the forceps, and its eagerness to take food from them, became more and more marked until its death, but it would never endure a touch, particularly on the hinder part of its body. The *Galathea* would remain for several days or weeks in its hole, then remove to the opposite corner of the tank, and afterwards move back again. It never seemed to conquer its fear of the Spider-Crabs. (2) Another specimen was placed in the same tank on January 13th. Its behaviour was essentially similar to that of the first one; but, although it gradually became less and less afraid of the forceps, it had not become confident enough to reach forward for food by the thirty-sixth day, when it died. Both animals died in the early stages of casting their exoskeletons.—H. N. Milligan.

Nereis fucata Eaten by Hermit-Crab.—It is well known that the worm *Nereis fucata* is often to be found in the shell inhabited by a Common Hermit-Crab (*Eupagurus bernhardus*), and that the worm will put out its head in order to snatch pieces of food from the very jaws of the crustacean. I wished to ascertain whether a Hermit-Crab would be as tolerant of a strange *Nereis fucata* if I tried to introduce the worm into its shell. I broke open a Whelk shell in which a Hermit-Crab had recently died. The worm retreated from whorl to whorl as each was broken away, and once it made a surprisingly vigorous stab at my fingers with its mandibles. When the worm was placed against the shell of a Hermit-Crab, the crustacean at once seized and began to eat it; and a Hairy Hermit-Crab (*Eupagurus pubescens*) also attacked the annelid. The worm, however, wriggled from the grasp of the Hermit-Crabs; thrust its head into the bed of (very tiny) pebbles; and then made its retreat beneath the pebbles in an eel-like fashion, the slight heavings of the surface marking its comparatively rapid progress beneath. I do not know what became of it afterwards.—H. N. Milligan.

NOTICES OF NEW BOOKS, Etc.

British Birds. Vol. IX, Nos. 2–12. London: Witherby & Co. 1s. monthly.

The May number of 'British Birds' concludes the volume of which we noticed the opening number last year. In the July number Miss A. C. Jackson has a paper on "The Moults and Sequences of Plumage in the British Ducks," in which she records a spring moult in the females, involving not only a change of the body-feathers, but a new growth of "nesting down" beneath them. Mr. G. T. Atchison describes and illustrates with photographs nests of the Lapwing containing five eggs. In the August number Mr. J. H. Gurney and Miss E. L. Turner describe the nesting of a Long-eared Owl in Norfolk on the ground, with particularly fine photographs contributed by this lady. Miss Haviland records photographically the half-diving of a Black-headed Gull when feeding, an act many of us must have witnessed both with this species and the Herring Gull; and on the next page there is a photograph of a nest of the Common Tern, taken on Gardiner's Island, off Long Island, U.S.A., with no less than ten eggs. Another with six is recorded, so that in this large colony of about 1000 pairs the birds show some slight inclination to "pool" their eggs like common Fowls. The note is by Mr. H. Massey. Miss Haviland opens the September number with a paper on the nesting of the Asiatic Golden Plover, illustrated by photographs; the young of this species she finds much brighter in colour than those of the western. A most interesting record is that of Mr. A. H. Mathew of a flight of about a hundred Alpine Swifts seen in Kent on July 15th, 1915; small numbers were also seen on the 22nd and on August 3rd. A curious thing is that in two cases it appeared probable that these birds settled on the ground. Mr. C. E. Milburn records the killing of some nestling Meadow-Pipits by a Cuckoo. A most regrettable record is the killing of a pair of the magnificent Caspian Tern at Jury's Gap in Kent; people who cannot recognise and spare conspicuous birds like this ought not to be allowed out with a gun. In the October part we find a record, illustrated by a good drawing, of a rare bird seen and not killed, an Eastern Black-eared Wheatear, observed and sketched in Yorkshire by Mr. W. S. Medlicott. Mr. W. J. Williams records the breeding of the Black-necked Grebe on one of the western lakes in Ireland, as evidenced by the capture of a young one in the "flapper" stage,

which was sent to him. In the November number Mr. F. W. Smalley takes up the subject of the moults in British Ducks, started by Miss C. Jackson, with both critical and confirmatory remarks on her paper. Mr. E. B. Dunlop contributes notes on the Great Northern Diver's nesting-habits in Canada, illustrated by photographs which are unfortunately not very clear, except that showing the nest and eggs. Mr. Witherby commences a series of papers on "The Moults of the British Passeres." This is continued in the December number, in which also Miss Haviland discusses the Grey Plover in its haunts on the Yenesei. Mr. W. J. Ashford records the visit, for six years in succession, of a pair of Black Redstarts to the parish church at Blandford, Dorset, where they spend the late autumn and early spring, the male coming several days before the female. The January number is largely occupied by short notes on rare birds on the British list, among which the Moustached and Olivaceous Warblers are illustrated by photographs of British specimens. In that for February Mr. Witherby continues his notes on the plumage of the Passeres, Miss Haviland notes and illustrates the habits of the Lapland Bunting on the Yenesei, and Mr. Witherby reports the progress in 1915 of the "British Birds" bird-marking scheme. The subject of the recovery of marked birds also receives attention in the March number, wherein also Miss Turner discusses the ways of Coots and Moorhens; a photograph of the latter displaying, though not too clear, is very interesting. This is part of a series on "Wait and See" Photography, which runs through several numbers. It figures also in the April issue, the most interesting record in which number is one among some Manx ornithological notes by Mr. P. G. Ralfe, on the breeding of the Chough in a ruined mine-building, a photograph of the site being given. Mr. C. J. Carroll notes the breeding of more than sixty pairs of Siskins in South Tipperary. The May number, as the last of the volume, contains, of course, the index, and has also instalments of Miss Turner's photographs and notes, and Mr. Witherby's discussion on the Moults of British Passeres. Miss Turner's description of the amicable social play of male Sheldrakes whose mates are sitting is well worth reading, as is also the short note by the Duchess of Bedford on a male Fire-crest seen in Bedfordshire, apparently displaying to a hen Gold-crest.

Editorial Note.—For the benefit of new readers we mention here that the daggers (†) in Mr. Gurney's paper indicate that the specimens have been inspected by him. [See 'Zool.,' 1915, p. 125.]

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THE ZOOLOGIST

No. 901.—July 15th, 1916.

HINDU ZOOLOGICAL BELIEFS.

By W. Rae Sherriffs,
Professor of Zoology, Madras Christian College.

To the British student of zoology the various animals dealt with in the college course have no meaning outside their value in the science itself. On the other hand, the Indian student of zoology cannot but remember, many a time in the course of his reading and of his work, stories of the part played by animals in the annals of his native land.

In the following pages we shall record some of the prevalent beliefs concerning animals, their uses, and the *rôle* they play in the mythology of South India. For this purpose, then, it will be sufficient to take the animal kingdom as divided into the two main groups, vertebrates and invertebrates, and to discuss under each phylum those animals which have a special interest for us.

Invertebrates.

All the early phyla, the Protozoa, Porifera, Cœlentera, and the various groups of Worms, give us no animal of sufficient importance to be recorded in any tale or used in any particular way. That the first lot, the Protozoa, the smallest and earliest of animals, should be omitted is not surprising, for most are microscopic, and in the days when the great epics, the

Mahabharata and the *Ramayana*, were composed, such a thing as a lens was unknown. Even to this day the person who is not a zoologist or microscopist passes through life without ever seeing a Protozoon. As for the parasitic Protozoa causing diseases in man, such an idea is of quite recent date, and in India it is, of course, evil spirits that do all the mischief.

ARTHROPODA.—This is the first group of which various members come under our notice. The crustacea are represented by the little Calling-Crab (*Gelasimus*), so common in estuarine mud banks. One claw in the male is ridiculously large, bright red, and constantly waved in the air, a habit which has given to the Crab locally the name of the "dhobie" (washerman) Crab. The Centipede must not be killed, because it is believed to be the only son of its mother (women, however, are allowed to kill them); neither must Millipedes be slaughtered heedlessly, but for a very different reason, for the propitiatory sacrifices in such a case must equal in number the legs of the victim. Insects are plentiful enough in India in all conscience, and accordingly we find them alluded to for various reasons. The common "Silver-fish" insect (*Lepisma*), which proves such a nuisance in the bungalow by nibbling books and papers, is no less than the arrow of Rama. Look at the shape of its tail and see the resemblance. Another pest to the European is the Cock-roach, which, however, is always made welcome by the Hindu, because it is an emblem of plenty and also brings luck. The small Grasshopper, from its bright green colour, is often called the "little Parrot." The Mantis, so well known by its habit of reverently moving its first pair of legs as if intent on its devotions, is named the "shepherd" or the "milkman." The common Mole-Cricket (*Gryllotalpa*) in the wet season frequently enters houses. In connection with this insect there is a curious belief. When a woman is sterile, then it is some kind of insect within her which is preventing conception. In order to destroy it another insect must be introduced alive. *Gryllotalpa* is therefore taken, rolled up in sugar (jaggery) and swallowed whole. The Mole-Cricket must never be killed, probably for this very reason, and in Tamil its name means the "child insect," most likely because of its use as recorded here. It is harmless, and its harmlessness has become proverbial. So much, indeed, is

this the case that it is said that if an insect stings you it must be a Scorpion, but if it does not then it must be a Mole-Cricket.

As might be expected, the Butterflies, from their beauty and daintiness, are the "dancing girls" of the insect world. White Butterflies, from their clean appearance, are termed "washer-women." The Hindu has noticed the Wasp stinging the Caterpillar, but he differs very much from Fabre in his account of what really occurs. According to the Hindu, when a Wasp stings a Caterpillar, then the Caterpillar becomes a Wasp. Thus may a bad man corrupt a good one, for the Caterpillar, though at first harmless as such, after becoming a Wasp, can sting.

Bees are mentioned in tales several times. If they construct their honeycomb in a house, it bodes evil for the dwellers within its walls. Familiar to all in India is the big, handsome, blue-black Carpenter-Bee (*Xylocopa*), which is often seen in the bungalow prospecting for a hole into which it can climb to lay its eggs. This Bee figures in the well-known story of Bringi. One day a "rishi" (sage), Bringi by name, who used daily to worship Shiva, wished to worship Shiva alone. This he could not do in human form, because the god's consort, Parvati, was wont to sit on Shiva's lap. Now, as we know, the Hindu idea of worshipping is to walk round the god so many times, the oftener the more intent is the worship accorded. Bringi's difficulty, then, was how to get round Shiva, whom he wished to honour, without at the same time encompassing Parvati, and thus doing equal homage to both. Bringi bethought himself of changing into this Bee, and did so, flying round Shiva and then boring between him and Parvati. Both the deities at once saw through the trick; Shiva felt complimented by the rishi's devotion to himself, but the lady was very angry. In fact, she grumbled so much at the disrespect shown her, that, in order to pacify her, and to prevent a recurrence of the incident, Shiva incorporated her body with his own. From that day he became Arthanari—*i.e.* half-woman—so that, as thus represented, Shiva has one side of his mouth with the moustache, the other without, one arm that of a man, while the other is slender and adorned with bangles.

This change from the human form to that of a Bee also enters into the tale of King Mahabali, whose ancient home, Mahabalipuram—better known perhaps as the Seven Pagodas—

is some thirty-five miles south of Madras. Vishnu is said to have visited this earth of ours several times, in each case to right wrong, and on two of these occasions a Bee plays a conspicuous part in the story.

Mahabali was one day performing a sacrifice (yaga), at which time every desire of a visitor must be granted. In order to test him, Vishnu took the form of a dwarf (Vamana) and entered the hermitage where the king was. Appearing before the Raja, Vishnu asked, as a reward for the performance of austerities, as much ground as he could cover with three steps. Mahabali, being a great king and deceived by the size of his small visitor, readily granted the request, notwithstanding the advice of his "guru" (spiritual adviser), Sukrachariar by name, who recognised the god and saw that he plotted to ruin the king. In performing the yaga, water is poured from a small vessel (gindi or muku chembu) into the outstretched hands of the visitor while the request is granted. In order to prevent the water escaping from the vessel, the guru at once changed himself into a Bee, and flew up the spout of the cup, thus stopping the flow of water and preventing the gift being made. Vishnu knew quite well who the Bee was, and poked it out with a little stick. In so doing he unfortunately knocked out one of the Bee's eyes, so that ever after the guru was blind of an eye, and even to this day a one-eyed man is referred to as Sukrachariar.

The small black Ants which swarm everywhere throughout the plains are specially connected with Ganesa. For this reason it is very sinful to kill them. Ganesa (the Elephant or belly god) is said to be very fond of the white sweetmeats (korokottai) sold in the bazaars, and the Ants resemble him in that they are frequently seen moving about carrying their small white "eggs."

The Scorpion is popularly believed to liberate its young by bursting its back, an idea obviously due to the fact that the mother Scorpion often carries her young on her back. Ganesa is said to send a Scorpion to sting anyone who has offended him. When you see the Scorpion approaching, you have only to repeat the god's name, when it will stop and not harm you. That is the theory, but in actual practice we believe that it does not work.

The Head-Louse is only too common in India, and hunting for these vermin on each other seems to be the sole recreation that the ordinary coolies have. It is interesting to note that if one falls to the ground in Madras it is certain to go north, west, or south, but never east, because then it would certainly before long fall into the sea.

The beautiful Harvest-Mite (*Trombidium*), with its body seemingly made of red velvet—indeed, the Tamil name means "velvet insect"—has a quaint story as to its origin. Sita one day was chewing betel, and on expectorating on the ground, what was her delight to find that the unsightly mark moved away as the lovely Red-Mite.

Mollusca.—The Lamellibranchs (bivalves) are not mentioned as such, but as they are the pearl-producing group we may note that pearls are said in India to arise in three ways: (1) From the Crab or Oyster (the Tamil name for both these is the same, so that the South Indian is certainly not a zoologist), (2) from the hollow stem of the bamboo, (3) from the Elephant's tusks. These are the places where you may confidently expect to find pearls. As to how they ever got there—well, as Mr. Kipling says, "that's another story." Only, remember that the best pearls come from the Elephant's tusks.

Requienia ammonea has its small right valve fitted on like an operculum. These stony valves are picked up on the beach at Rameswaram in large numbers, and pilgrims to that famous shrine usually buy them and bring them home as curios to be distributed among friends and relatives as a souvenir of the holy place. To the Hindu these little things are the eyes of the demon Ravana, King of Lanka (Ceylon), who fought against Rama, one of the "avatars" (appearances on this earth) of Vishnu. In the personal conflict between the champions in Lanka, Rama had cut off Ravana's ten heads a thousand times, but no sooner was one head severed than it was regrown. Rama was unable to conquer so long as Ravana's heart contained the holy nectar (amritha), but whenever Rama's arrow pierced his heart and broke there the vessel containing the nectar, then the heads ceased to grow. As Ravana had a pair of eyes in each of his ten heads, all of which were cut off a thousand times, he left twenty thousand eyes behind him on the shore, and as all

the rest of his frame has disintegrated long ago, only those eyes now remain. Of this there is no doubt, for the brown marks on the valves, are they not the stains of the blood shed in the mighty conflict?

The most important Mollusc is undoubtedly the Chank (*Turbinella rapa*), which is of special interest from its connection with the religion of the Hindu. Diving for these shells forms a fishery of considerable value in South India under the control of the Government Fisheries Department, with its headquarters at Tuticorin. The Chank is one of the weapons of Vishnu, who is always represented as holding it in his left hand, while in his right he grasps the "chuckram." The Chank is the symbol both on the postage-stamps and on the coinage of Travancore, while the coin is the chuckram. On the stamps of the first issue of Cochin the Chank is represented along with other objects.

The common Chank shell is dextral, *i.e.* the opening faces to the right of the holder when looking into it with the apex of the shell pointing upwards. The sinistral condition, *i.e*—with the opening to the observer's left—is very rare. The "Cambridge Natural History" (vol. iii, p. 100) records from Thurston that in 1887 a sinistral form obtained in Jaffna was purchased for 700 rupees. Popularly, the relative values of Chank shells are as follows: The common form sells at about 1 rupee per dozen, the sinistral is worth one thousand times this sum, while it is in turn only a thousandth part of the value of a special form (salanjalam), which again is only a thousandth part of the value of the Chank which Vishnu himself wields, which is the only one of its kind in the universe. On this enumeration, Vishnu's Chank (panchajanyam) is worth a thousand million times the value of a common Chank, a sum somewhere about £5,500,000 approximately. Of course, these two last shells are purely mythical.

The uses of the Chank are various. Many are cut transversely into slices, which are used as bangles by Indian women. The Chank is used in temples for pouring libations over the god. It is a sacred emblem. The ordinary form is employed in all Hindu homes as a feeding-cup for children, and also in ceremonies as the vessel from which the libation is poured. It is also used as a trumpet, both at weddings and at funerals, at

which its note is supposed to reach heaven, and prepare by its onward ripplings the way for the soul in its flight from earth.

The Snail is the common Gasteropod mollusc, and he is the little man who carries water for the Snake, which will eat him if he does not. This is why the Snail moves so slowly. He is afraid to spill the water he carries in his shell.

The Cephalopoda, as represented by the Cuttle-fish, are very common in Indian seas. The internal shell is often washed ashore on the sandy beach at Madras. This shell is said sometimes to be taken inland as a curio from Rameswaram, and is believed to be made of the sea-foam, like the meerschaum of the Baltic. The cuttle-bone is used for various purposes, for cleaning slates and harness, for example.

Echinoderma.—This phylum has no members about which stories are current. The thick spines of a Sea-Urchin * are sometimes used by schoolboys as slate-pencils. It is noteworthy that phyla of characteristically marine animals—*e.g.* Porifera, Cœlentera, and Echinoderma—do not figure in this record. The early Hindus knew nothing of the sea and its animal denizens. At the present time the great bulk of the population of India has never seen the sea. To them it is a mere name. Probably the fishers round the coasts, who form a community by themselves, may have many tales of life in the ocean, for they go down to the sea in catamarans, at least in Madras, but any such tales are unknown to land-folk.

Vertebrates.

These include all the larger and better known creatures, so that in enumerating stories connected with fishes, amphibians, reptiles, birds, and mammals, our difficulty is not so much to find matter as to select from a mass of mythological lore what is really relevant.

Fishes.—The great majority of fishes are marine, and of them we can find nothing worthy of being recorded. The fish-shape, especially that of *Barbus* (a common fresh-water fish of the Carp family in South India), is much admired. To have eyes fish-like in shape is considered a type of beauty, and this form is got by blackening the eyelids with material obtained by

* Stomopneustes.

charring rice, mixing it with "ghee" (clarified butter), and extending the mark as the tail of the fish on to the cheek. Meenakshi, a favourite Tamil name for a girl, means fish-eyed.

It is related that the patriarch Manu (Noah of the Scriptures) caught a small fish which begged for its life and promised a reward for its preservation. Manu thereupon put it back again into the water. When the great deluge came and he took refuge in the ark, the friendly fish reappeared and towed the boat by a rope attached to its horn, until at last, on the waters subsiding, the ark grounded on the mountain-top.

Matsya, the fish avatar of Vishnu and also the first avatar of the god, came about in this way. The four-headed Brahma at the beginning gave forth a Veda from each of his four mouths. The four brothers, Mathukaitapas, the rakshasas (demons) stole them, and in order to avoid capture left the land and took to the sea, thinking to be safer there. They did not escape, for Vishnu, assuming the shape of a fish, pursued them. When the brothers perceived this, they changed themselves into little children and swam to the god for protection. Vishnu, however, when they reached him, hugged them all so close to his breast that he slew them, and so recovered the priceless Vedas.

This event took place at the time of the great flood. One account states that the fish which befriended Manu and saved the ark, with its occupants, was Matsya.

Amphibia.—Frogs are not favourites in India. The common "Chunam Frog" (*Rhacophorus*) is detested and feared by women, because, if one leaps upon an expectant mother, the child born will be sickly and lean as the frog itself. Should a woman be touched by the animal, all evil consequences may be averted by catching a "Chunam Frog," killing it, frying it in oil, and then giving the baby a few drops of the liquid to drink. *Rhacophorus* is also held responsible for destroying the coconut in the nut. In order to bring this destruction about, the Frog climbs the palm and merely smells the fruit. When chased or handled, this Frog has the nasty habit of expelling the contents of the bladder, and it is commonly believed that if the fluid touches the skin it will cause a wound which will be painful and slow to heal.

Reptilia.—This class contains the Crocodiles, Lizards, Snakes, and Turtles, all of which are found in India. The

Crocodile is the vehicle of Varuna, the Jupiter Pluvius of Indian mythology, who presides over the waters. It figures in the following story: Uhu, a demigod, was one day diving in a tank (pond) where a "rishi" (sage), Devala by name, was worshipping the water. Uhu in sport pulled the rishi's legs, for he was standing in the water while worshipping. The sage at first thought that it was a Crocodile that had got hold of him, but, on finding it was only a demigod that had played him the trick, he cursed Uhu, and made him become a Crocodile in real earnest. King Indraduma, the story continues, was an ardent worshipper of Vishnu, and one day, when performing his devotions, he was interrupted by the rishi Agastya, who came and asked the favour of an interview. The king continued his worship, and paid no attention to the request, whereupon the sage, highly offended, remarked: "I see you are as proud as an Elephant. You shall be one henceforth." Thus it came about that both Crocodile and Elephant found themselves in the same pool. Indraduma, as the Elephant, continued still to be devoted to Vishnu, and daily used to enter the water, pick a lotus, and lay it as an offering before the god in the temple near by. Once, when the Elephant entered the tank, it was immediately seized by the Crocodile (Uhu), and a very protracted fight, lasting for a thousand years, ensued. Eventually the god himself came and delivered his devotee, the Elephant.

Such is the tale so well known throughout India as the Gajenda moksha (the deliverance of the Lord of Elephants).

Among Lizards the Gecko is of great importance. The day of the week and the direction from which one hear its voice, also the part of one's body upon which it may fall, are concerned. The Gecko is one of the commonest animals in South India. It is the only reptile with a voice which is easily heard. Since Geckos are so very common inside houses, one can scarcely pass a day without hearing them calling, while frequently they fall from ceiling, wall, or pillar.

The following tables are translated from the Hindu Almanack (Panchangam), and explain—(1) what the Gecko's notes forbode; (2) the fortune resulting from the creature touching the body. It is worth noting that in the first table the Hindu recognises ten directions from which the sound may come.

TABLE 1.—OMENS FROM VOICE OF GECKO.

Day.	E.	S E.	S.	S.W.	W.	N.W.	N.	N.E.	From above.	From below.
Sunday . .	Fear	Evil	Health	Meeting a relative	Fighting	New clothes	Money	Profit	Success	Realisation of all hopes
Monday . .	Money	Dissension	Enmity	Quarrel	Entering the King's Court	Bad omen	New clothes	News of a marriage	Bad news	Riches
Tuesday . .	Peace and plenty	Regaining a relative	Sorrow	Fear of an enemy	Success in the work on hand	News from distant lands	Fear of an enemy	Getting up a *vaganam* (*cf.* horse, elephant)	Travel to a foreign land	A very good income
Wednesday .	Happiness	Money	Bodily affliction	Loss of a relative	Fear	Loss of wealth	Health	Failure in the work on hand	Good news	Riches
Thursday .	Inauspicious	Respect from relatives	Money	Realisation of all hopes	Loss	Good words	Failure in the work on hand	Good food (wholesome food)	Dissension	Dissension.
Friday . .	Good news	Good dress and jewels	Meeting a relative	Good news	Joy	Dissension in the house	Dissension	Fear of an enemy	Recovering a lost thing	Bathing after pollution from hearing death news
Saturday .	Very good news	Progeny and money	Meeting the King	Disease	New clothes	Desire gratified	Welcome news	Fear of thieves	Failure in the work on hand	Realisation of all hopes

TABLE 2.—OMENS FROM FALL OF GECKO ON THE PERSON.

Part of body.	Result.	Part of body.	Result.
Head	Dissension.	Navel	Income of diamonds.
Face	Meeting a relative.	Either side (sideways)	Good profit.
Eyebrow	King's grace.	Thigh	Father's ruin.
Upper lip	Expenditure (unnecessary).	Knee	Auspicious.
Lower lip	Money.	Ankle	Auspicious.
Nose	Attack of some disease.	Foot	Travel.
Right ear	Long life.	Woman's breast	Sinful deeds.
Left ear	Profit in merchandise.	Buttocks	Auspicious.
Eyes	Imprisonment.	Nails	Loss of wealth.
Chin	Punishment from the King.	Hair	Fear of death.
Mouth	Fear	Top of the head	Death.
Neck	Enemy's ruin.	Forehead	Coronation.
Right shoulder	Health.	Left arm	Sorrow.
Left shoulder	Desires gratified.	Right arm	Mishap.
Right wrist	Misery.	Back	Loss of property.
Left wrist	Fame.	Toes	Fear.
Male organ	Poverty.	Left hand fingers	Sorrow.
Chest	Money.	Right hand fingers	Fear.
Belly	Income of grain.	Along the whole body	Long life.

Another Lizard common around bungalows is the small delicate-limbed one with a red tail in youth, known as *Lygosoma*. Its bite is said to cause instantaneous death, and it is avoided as the plague. For all that it is a very pretty and quite harmless little reptile.

Varanus, the largest Lizard in India, can usually be seen for sale in the market. It is killed and eaten, as its flesh is considered to strengthen the body. The Mahrattas are credited with having made use of this animal, which may reach five feet in length, in their raids. To enable them to scale the wall of a fort, the Lizard had a stout rope passed round it, and was made to climb up the wall, which it easily did by means of its sharp claws. Once the animal was over the top the men singly climbed quickly up the rope and entered the building.

Mabuia, another familiar Lizard, has a peculiarly aimless mode of progression. Consequently anyone who constantly changes his mind is said in Tamil to be of the "aranei" (name of *Mabuia*) type.

The well-known Blood-sucker (*Calotes*) has nowadays a yellow colour, but in the distant past it was of quite a sombre hue. A certain king (Marutha) was once performing a ceremony, and all the devas (gods) were present, chief among them being Indra (king of the devas), Yama (king of death), Varuna (lord of waters), and Kubera (god of wealth), when suddenly the demon Ravana appeared, whereupon each of these four gods at once assumed the form of his mount—Indra becoming a Peacock, Yama a Crow, Varuna a Swan, and Kubera *Calotes*. Ravana, noticing merely the animals, went away without recognising that they were the gods themselves. Up to this time all four animals had been black in colour, but when the demon retired each deva retransformed to his usual shape, and each gave his animal a boon. The Peacock got its beautiful plumage and the thousand eyes of the god now seen in its tail-feathers. It was also made immune to snake-bite. Yama promised the Crow that it should never die unless slain by man, that it should always be healthy, and that it should always, when eating, do so in company. For this last reason people call the Crows down to join in their meals, but it must not be forgotten that the souls of their fathers in heaven are satisfied when they see the Crows fed. The Swan was made white by Varuna, who said that from henceforth it would feel much more at home on water than on land. Kubera's favour to *Calotes* was to make it his own colour, that of yellow gold.

Snakes are so very common that they enter of necessity into the life and worship of the people. Probably the very earliest form of worship in India was simply that of the Snake. The Hindu recognises nine Snakes, all concerned in supporting the world. First of all and most important of these comes Adisesha with its thousand heads, upon which Vishnu reclines as it floats on the sea. This great Snake, according to one account, supports the world. Sometimes the globe rests heavily upon it, so that it shakes a little, and dwellers on the earth feel the tremors of earthquakes. Yet the Snake is patient and enduring in its task, and man should emulate its uncomplaining spirit. Man should be patient as Adisesha.

Long, long ago Adisesha quarrelled with the wind as to which was the stronger of the two. The great Hindu trinity—

Brahma, Vishnu, and Shiva—were the judges, and the contest agreed upon was after this fashion. Adisesha covered the thousand peaks of Mount Mahameru with his thousand hoods and wound his body round the base of the mountain. Then Vayu, the wind, came with all his might, and after several years succeeded in blowing off three of the peaks, which fell far in the sea hundreds of miles away, and Lanka was built upon them. Certain authorities consider that Mahameru was where the Altai Mountains now stand, and the three peaks landed where the present day Trincomalee now is.

Vasuki is the Snake used as the rope in the famous episode of the churning of the milk-ocean to form the nectar (amritha), the drinking of which made the devas immortal. Away far beyond the Himalayas stood Mount Mahameru, supported on a tortoise that was Vishnu. The Snake's body was coiled round the pillar-like form of the mountain. The devas held the tail, wisely leaving the venomous head to the asuras (demons). Then the gods at one end and the demons at the other moved the Snake just as the Hindu carpenter to-day works his drill. When the precious fluid was ready, the devas and the asuras seated themselves opposite each other on the ground to partake of this elixir of life; but one asura, Rahu by name, foreseeing that the devas alone would get the amritha, crossed over and sat with them between the sun and the moon. Vishnu now went to pour out the nectar, and in order that he might give to the gods only and not to the demons, he assumed the form of a most beautiful woman, Mohini (the temptress). He thus hoped to secure the undivided attention of the asuras directed to his beauty, so that he might pour out all the soma to the gods and leave none for the expectant demons. The ravishing form of Mohini secured the fixed attention of the asuras, and she had given the drink to Rahu and thus made him immortal, when the sun and moon pointed out to her the mistake she had made. Mad with anger at being deceived herself, she struck Rahu with her spoon and split him in two. Hence it comes to pass that we have the two Snakes Rahu and Ketu, which are now planets, which, on account of the old grudge they bear the sun and moon, at every eclipse devour these heavenly bodies.

Vasuki at first was the most poisonous of all the Snakes, but

he gave out his venom at the churning of the milk-ocean. This vast amount of deadly fluid would have poisoned every living thing had not Shiva himself come to the rescue and drunk it up. But even he did not escape scatheless, for the virulence of the draught was such as to turn his throat to a blue-black colour, whence arises one of his names, Nilakantha.

Four other Snakes are Ananda—who was an ardent worshipper of Vishnu, and whose name is a common one among Vaishnavites to-day—Kuliha, Padma, and Mahapadma.

Karkotaka is very venomous. He is one of the eight smaller Snakes that accompany Adisesha. He also enters into the story of Nala and bites him during his wanderings in the forest, and so delivers him from Kalki, the god of strife, who is to be the tenth and last avatar of Vishnu. Karkotaka is held to be very sacred, and is remembered by the orthodox Hindu on rising every morning.

There are nine Snakes employed in upholding our world. Adisesha is the largest, and directly supports the globe, while round him the eight others lie towards the points of the compass in the following order: Vasuki (E.), Ananda (S.E.), Takshaka (S.), Sankapalah (S.W.), Kuliha (W.), Padma (N.W.), Mahapadma (N.), and Karkotaka (N.E.).

Takshaka, the most poisonous of all, is the king of the Snake-folk who live in the under-world. He once stole the jewels that Uthanga was taking to his guru's wife. He it is also who narrowly escaped being burnt alive with all his kindred before Janemajaya, whose father, Parikshit, he had slain.

Kaliya was a Snake with a hundred heads, who dwelt in a tank and was so poisonous that not only the water in the pond, but the grass on its banks was envenomed, and even a bird flying over the fatal water fell dead from the poison-laden air and moisture. Krishna fought with him under the waters and destroyed all his heads save one, when he allowed the Snake to depart. Kaliya was afraid to go, for he knew that Krishna's bird (Garuda) would fight him at sight and kill him. Krishna then put his foot-print on the Snake, leaving a mark which Garuda would respect. The *namum* remains to this day on the inflated hood of the Cobra.

The Cobra is the best-known Snake in India and is widely worshipped. There are several common beliefs current about this Snake. The Cobras of the highest caste have a ruby (manickam) on the top of the head. When the Snake is wandering at night in search of food, it places this gem on the ground, and by its light it is able to see its prey. A very wide-spread idea firmly held is that the Cobra is only the female, while the Rat-Snake (*Zamenis*) is the male. If a man see the pair together and is noticed by them, then he must take to flight at once, for both Snakes will pursue him relentlessly, especially the Cobra. In such a predicament the best thing to do is to throw off some part of one's clothing, which the pursuing reptile will then seize and bite savagely. The fact that there are male and female Cobras, as well as Rat-Snakes of both sexes, present in thousands in India, will not make the Hindu give up his belief in this fantastic tale.

According to the Indian there are three animals in the world that love music—the Snake, to which the charmer always pipes; the Cow, to which Krishna, as the cow-herd, played his flute; and a baby. The middle finger in Tamil is known as the snake-finger, and no ring is ever worn upon it, because if this is done then a Snake is sure to bite the owner during the night. If a venomous Snake does not bite a human being then it gradually gets smaller and smaller. Finally, when very minute, it acquires wings and flies about in the darkness. Some people away in remote country districts claim the ability to see these peculiarly attenuated flying Serpents, and can point them out at night while they are on the wing.

We have previously referred to the fact that Snake worship is very common in South India, and is practised by all castes. In almost every village you will find snake-stones set up. These stones bear upon them very roughly carved representations of a single Cobra with inflated hood, or of a couple of Cobras entwined. When a married couple have no children—his religion demands that every Hindu must have a son to perform the necessary ceremonies after his death, so that his soul may have bliss in the hereafter—they think they have in some way offended Subrahmanyam, the snake-god. They therefore repair to the snake-stones of the village, and worship the god by

walking round them several times, or they may pay someone to make a snake-stone, which they then take to the temple and present to the god as a votive offering. We have seen a cart-load of discarded snake-stones lying about in the courtyard of Belur Temple. It is significant that Subrahmanyam is, perhaps, the commonest name in South India.

Still another way of appeasing the snake-god is to take some milk or ghee as an offering, and pour it down the holes in ant-hills in which Cobras are known to dwell. The Cobra is then expected to acknowledge the gift by coming up and licking it. On the same principle as the ancient Greeks called the terrible Furies the Eumenides, so the Tamil Hindus speak of the Cobra as the "good Snake" (nulla pambu).

In Travancore and Cochin every house has in its garden a snake-stone or group of snake-stones, round which worship takes place every week. In Madras city Friday is the day for snake-worship, but there is also one special day in the whole year, nagasowthi, the fourth day after the new-moon in October. Shiva alone of the trinity of great gods wears Snakes as ornaments round his arms and neck. Brahma and Vishnu possess golden jewels, but Shiva, for various reasons, would not have gold. It is recorded that he considered all goldsmiths thieves, and would not trust them with his treasure.

As is well known, the Snake has two tongues, or more correctly, a single bifid tongue. How snakes got this peculiar organ forms a special tale in itself. In the golden age Prajapati had two fair daughters named Kadru and Vinata, the wives of Kashyapa, who, before retiring to the forest, gave each a boon. Kadru wished to have a thousand Snakes as her sons, all of equal splendour, while Vinata asked for but two sons, equal to all the sons of Kadru in strength, energy, size, and prowess. To his wives the husband said, "Be it so."

After a long time Kadru laid a thousand eggs, and Vinata a pair only. Five hundred years later the sons of Kadru hatched out, but Vinata's two eggs produced nothing, whereupon Vinata, feeling ashamed, impatiently broke open one of them, and saw her offspring as an embryo, with only the upper part of the body developed. On seeing his mother, the child cursed her, saying, "Mother, as you have prematurely opened this egg and did not

allow my body to be fully developed, being jealous of Kadru, you will yet be the slave of this same Kadru. But, O mother, if you are desirous of having your other son strong, take tender care of the egg for five thousand years." After upbraiding his mother thus, the child, Aruna by name, rose to the skies and became the charioteer of the sun, for he had strong arms. He may still be seen in the sky of the early morn urging his steeds forward.

At long length the second egg hatched out, and produced Garuda, the snake-eater. About this time the two sisters saw one day approaching them the gem of all horses—Uchaisrava—who arose from the milk-ocean at the churning of the amritha. "Tell me, sister," said Kadru, "without delay, what is the colour of this horse?" Vinata replied: "This king of the horses is white in colour. What colour do you think he is? Let us lay a wager on it." "I think his tail is black," answered Kadru," "but let the loser of the wager become the other's slave." When the horse came nearer, lo! its tail was black, and Vinata became subject to Kadru.

Many years after the losing of the wager, Garuda was repeatedly ordered by the Snakes to take them to some islands with an abundance of pure water. After reflecting for some some time the noble bird asked his mother why he should always have to do the bidding of these Snakes. Then did Vinata sorrowfully tell him of the lost wager and how she had not won, being deceived by the sons of Kadru, who, at their mother's command, became dark hairs in Uchaisrava's white tail, thus concealing the true colour. After she had ended, Garuda, in great grief, said to the Snakes: "Tell me, by bringing what thing or gaining what knowledge or doing what great work, we may be freed from this state of slavery." Then answered all the Snakes: "Bring us the amritha by force. Then, O bird, will you be free indeed."

After several attempts Garuda obtained the nectar, but, when returning, he met Indra, who was uneasy lest anyone should drink of it, and by so doing become, like the gods, immortal. Garuda promised him that he would allow no one to drink of the soma, and stated that he had good reasons for requiring the fluid. "O deity of the thousand eyes," said he, "after I lay

the soma down you can instantly take it up and bear it away." "Then, oviparous one," replied Indra, well pleased, "accept from from me any boon you wish." Thus addressed Garuda, recollecting the sons of Kadru, and the enslaving of his mother by their deception, prayed "O Indra, let the mighty Snakes be my food." And so it is to this day, for almost at any hour you can see Garuda (the Brahminy Kite) swoop to earth and again rise, bearing aloft a writhing Snake in its talons. Thus is the enmity between the two eternal.

Garuda flew to his mother with the good news, and gladly addressed the Snakes: "Here have I brought the nectar, and I shall place it on the sacred grass (kusa). After performing your ablutions and religious rites, drink ye it, but first of all, as ye promised, let my mother become free from this time henceforth." "Be it so," answered the Snakes, as they departed. Meanwhile, Indra, seizing the amritha, returned with it to heaven. The Snakes soon came crowding together in great joy to drink the soma, but found only the grass upon which it had been placed, and in licking this the stout stems of kusa split their tongues in twain.

Among living snakes the Tree-Snake (*Dendrophis pictus*), though harmless, is believed to be very poisonous. After biting a person it climbs the nearest palm, and on the top waits till it sees the smoke arising from the funeral pyre of its victim. Only after being so completely satisfied will it descend to the ground once more. This belief is so engrained in the native mind that the Tamils, whenever this Snake bites a man, actually make a mock funeral pyre by setting light to some straw, so that the Snake from its lofty position may see the smoke arising. The Snake, thus deceived, is said then to descend at once, and as it climbs down the palm the pain is believed to lessen in the body of the sufferer and the poison gradually to depart.

Another green Tree-Snake (*Dryophis mycterizans*) is also harmless, but has the peculiar habit of striking at a person's eyes. It is very important, because of a curious belief that any woman who is a bad cook, by touching it, will cook well ever after. A student bringing a dead one to college counted twenty women who came forward and touched it as he passed, in order that their cooking in future might be an assured success.

The Double-headed Snake (*Eryx johnii*) is harmless and often used by snake-charmers. The tail end is short and very blunt. Every six months the head is believed to change places with the tail.

Chelonians are represented in South India, but concerning them there is only one tale which refers to the second avatar of Vishnu, called Kurma, the Turtle. According to one version of the story, Vishnu took this form in order to recover the treasures lost in the universal flood, when, from the waters, among other things, the following animals were obtained: Uchaisrava, Khamadhenu (Cow of plenty), Kavat aira (three-trunked Elephant of Indra), and the Chank, which conferred victory upon whosoever blew it. Another account relates that when the churning of the milk-ocean took place, Mahameru began to slip down owing to the violent movements of the Snake Adisesha. In order to support the mountain, Vishnu came to the rescue, and by assuming the form of the Turtle and going beneath the mountain, he was able to bear it on his broad back. A variant of this tale is that the earth rests on eight Elephants, which all stand on the carapace of a huge Turtle.

This episode of the churning of the milk-ocean is such an important one that we may note the real meaning of the events which then took place. It has been said that the sea of milk is the ocean of existence. Mahameru is the world itself, the gods are good impulses and the demons bad ones, while the twisted Snake stands for time. Constant interaction of good and bad impulses in the world throughout the ages results in the formation of nectar, which is all the ideas of religion, civilisation, culture, art, and everything upon which humanity has been developed and has lived.

(To be continued.)

ORNITHOLOGICAL REPORT FOR NORFOLK (1915).

By J. H. Gurney, F.Z.S.

(Concluded from p. 209.)

August.

6th.—A Gadwall † shot on Hoveton Broad (Blofeld).

21st.—N.W., 4. Common Buzzard † taken at Rollesby (E. C. Saunders), a very early occurrence.

25th.—For several years Barn-Owls have nested in a large elm near my house, obtaining access through a broken limb to its hollow trunk. Here a descent of some 14 ft. is necessary to the nesting platform, and as the diameter of the hole is less than 3 ft., the mystery is how they get out of it. The young birds might clamber their way up, but it must be more difficult for the longer wings of the old ones. It is in fact on a large scale what a Woodpecker's hole would be, but then Owls have not got the Woodpecker's climbing feet.

The appearance of a White Owl in the day-time is sufficiently unusual to puzzle the small birds, but they realise that it is a mouse-hunter, and are not excited by it in the way that they would be by a Tawny Owl.

If a Barn-Owl comes abroad voluntarily, with the intention of mouse-hunting before twilight has set in, it is to be noticed that its flight is low.

September.

2nd.—N., 3 in the morning. N.E., 5 in the evening. As early as 4.30 a.m. a Greenshank, which had lost its bearings in the high wind, was seen by Mrs. Wathen on a lawn near Aylsham, quietly consorting with some Ducks by a pond. It was a wild night, which accounted for many Waders on the flats of Breydon, where the plaintive notes of the Grey Plovers were incessant (A. Patterson, see 'Zool.,' p. 374).

3rd.—N., 4 in the morning. N.E., 7 in the evening. The migration of Waders was not confined to Breydon Broad, for at a point about eleven miles further north and some four miles

from the coast Mr. Vincent watched a big migration heading north-east against the wind. This movement consisted chiefly of Dunlins, but also included, as near as could be guessed, some forty Reeves, fifteen Ruffs, seven Greenshanks, and five Bar-tailed Godwits.

6th.—From its partiality to tall trees, Beech especially, the presence of the Lesser Spotted Woodpecker would never be suspected but for its resonant hammering, the vibrations of which in early spring are quite as loud as the sounds produced by the Greater Spotted Woodpecker. To-day I had the good fortune to find one exploring a hole only 8 ft. from the ground, and, coming up gently, had a good view. The bird was apparently searching for insects inside the hole, which was an old Green Woodpecker's domicile.

Mr. Tracy, who has lately been making observations on the Lesser Spotted Woodpecker in Hampshire, has noticed that when making its tapping noise it keeps the beak wide open.

27th.—N.N.W., 3, to N., 5. At an early hour—7 a.m., wind north-west, with a falling glass—there was a considerable passing of Chaffinches at Northrepps, mingled with a few other small birds, all of them moving west and flying low. At the same time a sprinkling of Starlings, Wood-Pigeons, and Pied Wagtails were flying about indifferently. Although the Chaffinches were on migration, these three latter species were not so for the moment. In the course of the day the wind got up to point 5, and two flocks of Golden Plover appeared.

As a proof of how the wind varies, the following readings taken in Northrepps to-day at one and a half miles from the sea may be cited :

7 a.m.,	N.N.W.,	Force	3.
9 ,,	,,	,,	3.
11 ,,	N.	,,	4.
3 p.m.,	N.N.E.,	,,	3.
5 ,,	N.	,,	5.
8 ,,		,,	4.
10 ,,	N.	,,	3.

In the Broad district the wind was reported high by Mr. Vincent, who saw two Buzzards on passage, and at Yarmouth it was high also (N., 4 in the evening), This was the beginning of

the migration of Rough-legged Buzzards, which has been already reported in these pages ('Zool.,' p. 37).

28th.—N.W., 2. A considerable sea on at Overstrand. As is always the case after a high wind in autumn, Herring Gulls and Lesser Black-backed Gulls were to be seen passing continuously in little flocks, and, as usual, going north-west. If the wind changes to the east, the movement stops. With them was one Richardson's Skua †, and I observed the remains of another, which had met with some fatality, on the shore. A flock of forty Lapwings were also going north-west.

30th.—N.W., 3. [A Pelican reported on Breydon Broad (Patterson). It was seen by a gunner named Wigg, and was probably an escaped bird.]

OCTOBER.

1st.—N.N.W., 4. A solitary Snipe flushed by the Hickling keeper, and a Snow-Bunting seen on the hills by Mr. Barclay. Another Snow-Bunting was seen by Dr. Ticehurst actually in the main streets of Lowestoft. About fifty Martins † going north.

6th.—Common Buzzard † taken near Yarmouth (E. Gunn).

11th.—E.S.E., 5 at Spurn Head. Great flight of Robins in North Lincolnshire (G. Caton-Haigh).

12th.—A Yellow-browed Warbler shot in Suffolk (C. B. Ticehurst), for which the high wind yesterday morning (S.S.E., 5) may have been responsible. A much earlier occurrence was noted in Lincolnshire on September 18th by Mr. Caton Haigh.

13th.—Mr. F. N. Chasen reports an immature Gannet on the shore at Caister, and a Fulmar Petrel, which had been dead some time.

20th.—It was remarked to-day of a Red-throated Diver † picked up on the shore at Overstrand, that the skin round the eye in this species has a power of contraction, which is no doubt used when the bird submerges itself.

21st.—The horribly adhesive machine-oil which has been thrown out by our submarines has been very destructive to the diving sea-birds. To-day Mr. B. Dye picked up a Cormorant on Yarmouth south-beach stained brown, or rather black, by this mixture, which clogs everything that comes in contact with it. Mr. Patterson reports several washed-up victims, viz. a Rook,

Hooded Crow, Red-throated Diver, Little Grebe, Puffin, Guillemot, Razorbill, and Black-backed Gull. In a field a few miles inland Mr. R. Gurney saw a Black-headed Gull much stained, but still able to fly. Two Razorbills † which were given to me were saturated, as were I believe two Little Auks which fell victims at Blakenny (H. Pashley).

NOVEMBER.

6th.—E., 2. A couple of Ruddy Shelducks passed Mr. J. Vincent when at no great distance from the coast, flying due east. His attention was first attracted by the noise they were making, but as he watched them they kept rising higher and higher until lost to sight.

A Ruddy Shelduck, in all probability one of this pair, was shot on the 8th somewhere between Ludham and Yarmouth (E. T. Roberts), and another in the same neighbourhood on the 16th (E. C. Saunders).

10th.—Mr. Saunders received from Potter-Heigham a Black-breasted Dipper, † not showing any tinge of chestnut, and a Rough-legged Buzzard from Filby; and another about this time was shot at Snettisham.

Mr. Bird reports a Grey Shrike on Crostwick Common, where it had spiked a Sparrow.

12th.—A Little Auk † picked up at Northrepps under somewhat curious circumstances. A woman, whose chimney is used as the support of a telephone, heard the wire vibrate at about 4 p.m., and on going into her back yard some time afterwards, found there a Little Auk, which appeared, from a mark on its neck, to have struck the wire. This is not far from where one flew in at the open wicket of a stable a few years ago and was found by my gardener in a loose box. Is it possible that the Auks mistake the buildings for rocks in such cases?

15th.—A Little Auk † in a ditch near Keswick (H. Halls). My coachman succeeded in keeping it alive for a week. When swimming, if looked at from above, the white spot on the upper eyelid, which at other times is hidden, showed conspicuously, if the bird was excited. In illustrations this spot is generally shown when the bird is at rest, which is incorrect. In addition to these, I heard from Mr. Bird of one at Neatishead, besides which no

less than twelve were offered to Mr. Pashley, four to Mr. Gunn, two to Mr. Roberts, and two to Mr. Clarke. At Blakenny, where Little Auks have ceased to be a rarity, Mr. Pinchen saw three pass along the shore, and another struck a wrecked ship and killed itself. Previous visitations of the Little Auk to Norfolk and Suffolk were in October, 1841 ; December, 1846 ; November, 1861 ; November, 1878 ; January, 1895 ; and November, 1910.

19th.—A Black-throated Diver received from Barton by Mr. Gunn, and on the 26th another.

Passage of Swans.—Although we had no great severity of weather during November, flocks of Wild Swans made their appearance.

At Blakenny some were seen by Mr. R. Pinchen winging their way westwards, and at the same time considerable herds appeared on, or rather flying over, our largest Broad. This was particularly noticed by Mr. Vincent, who is in charge there, on November 13th—a rough day—when we had a high wind from the north-north-west, which at 8 a.m. registered force 6, but in two hours' time dropped to 4. Mr. Vincent has furnished the following notes:

5th.—An immature Whooper Swan.

12th.—Very low glass, with heavy rain in the afternoon. Eleven Bewick's Swans seen going west.

13th.—N.N.W., 6. Sleet. Flocks of 17, 13, 9, 7, 4 Swans, all believed by my informant to have been Whoopers, passed. He remarked that they were struggling against the strong north-west wind, and flying due west.

14th.—A flock of six and another of four Bewick's Swans, also going west against the wind, which had moderated to force 2.

15th.—Flocks of four and five Bewick's Swans going west.

16th.—Only one Bewick's Swan.

20th.—Three Bewick's Swans, one of them immature.

22nd.—Seven Bewick's (?) Swans going west.

28th.—Eight Bewick's (?) Swans.

The remarkable thing about this passage of Swans is that the 13th is almost the very day on which six great flocks came last year, all believed to be Bewick's Swans ('Zool.,' 1915, p. 142). Whatever they were, they were going in the same

direction, viz. west, which would take them straight inland if persevered in. Neither in 1914 nor in 1915 did any of these Swans, as far as we know, alight on Norfolk Broads.

27th.—Twenty-three Woodcocks bagged in the large wood at Felbrigge, after a north-easterly gale which reached point 5 at Yarmouth and Spurn Head yesterday evening, with snow, as I learn from Mr. Kerr.

December.

9th.—Garganey Teal, † immature male, shot at Martham (E. C. Saunders). In the 'Zoologist' for 1900 it is remarked (p. 103) that the Garganey is never seen in winter, but the above occurrence proves that there are occasional exceptions to this rule.

17th.—A Little Auk at Downham Market (R. S. Smith). A few black feathers among the scapulars of a Grey Crow † displayed as a scare-crow at Hempstead were very suggestive of hybridism, which is probably less rare among Crows than is generally supposed. At the same place a skein of forty Pink-footed Geese † was seen.

Varieties.

January 18th.—A pale variety of the Teal, a female, sent to Mr. E. C. Saunders, from Cantley.

January 30th.—A fawn-coloured Blackbird † at Mr. Roberts'. Another † at the same time at Keswick, with a patch of white. This bird remained all the winter, but disappeared in March, only to return to the same shrubbery the following December, where it remained for four months.

August 31st.—A white Martin under the eaves of the Swan Hotel, Horning, and another in a nest at Hill-crest House, Cromer (H. Cole). Also a pale Sand-Martin at Hickling, and a silver-grey Swallow at Stokesby (Saunders).

October 18th.—A variety of the Moorhen, † with silver-grey under-parts, the feathers being of a hair-like consistency, and a mantle which might be described when fresh as golden-brown, was shot at Rollesby (Saunders). In a normal Moorhen the interstices between the barbs of the feathers are filled up

with barbules, which stand in the same relation to the barbs as the barbs do to the feather's stem. In the present specimen many of the barbules are wanting, which affects the texture of the whole plumage.

October 30th.—A white Moorhen, † in fact an albino with pink eyes and legs, taken in East Norfolk, was received by Mr. E. T. Roberts, a variety quite as uncommon as the one last mentioned.

The daggers (†) indicate that the specimens have been inspected by the recorder.

A DIARY OF ORNITHOLOGICAL OBSERVATION MADE IN ICELAND DURING JUNE AND JULY.

By Edmund Selous.

(Continued from p. 152.)

Sigurdsson tells me that he has, to-day, for the first time, seen a Phalarope dive. He was quite near to it, he says, and could not have been mistaken. This supports my own conclusion founded on my, all at once, not seeing this or that bird that had been on the water just before, though I never did actually see it either disappear or reappear.

The island I am on illustrates very well the steps by which this species may have taken to the water in a gradually increasing degree, being, at first, only a wading bird. For here are places adapted for wading, in close juxtaposition with what are still its breeding-haunts, and were, no doubt, once the scene of its general activities. From them an increasing number of individuals advanced more and more, and farther and farther into the water, till they took to paddling, and, becoming thus water birds proper, lived in it, without respect to the character of the adjacent land, so that they now have often to fly some little way, to get to the old, still-desired breeding-places.

One may often see one of these Red-necked Phalaropes floating, apparently, backwards, down a strong or even violent stream. When looked at with more attention, however, it seems to be endeavouring, quite futilely, to swim against it, but not at all uneasy at not being able to. This is on the broad, rapid torrential river that issues from the great lake, where I crossed it. In miniature, however, I have seen the little bird prettily caught, in baby rapids, above a baby waterfall of a tiny stream, turned round in the rapids and floated backwards over the waterfall. But whether it was a real, involuntary turning round, or that thus going backwards, even though with some show of

paddling, in the usual way, has become habitual to the bird, I cannot feel sure about.

After having made the above observations on the Phalaropes, I went to the nest that a pair of Great Northern Divers have, as before mentioned, built, or rather laid down, on the shore of this island. It was a depression which at first seemed to have been formed by the pressure of the bird's body, merely, amidst the grassy herbage of the bank, but investigation showed that some of this had been detached, which implied construction, though of a rude kind. The situation of this nest at once struck me, for here was no shelving shore, as a means of approach to it, but, on the contrary, a perpendicular bank, at least six inches in height, but, I should think, an inch or two more than that. To surmount it, the birds must have made a tremendous leap out of the water, which tallies with what I saw in the case of the pair I watched, though here, so far as I can remember, both the height and the steepness are greater. One cold and bad-looking egg lay in the nest, which, Sigurdsson said, the parents would have paid no further attention to, after the advent of the first chick to hatch out, with which they would have gone off, almost immediately on that event taking place. He told me that, according to report, this is the common practice of these Divers, however near the unhatched chick may be to leaving the egg, even though it should be chipping the shell. This would seem a strange unnatural habit, but I am inclined to think that the abandoned egg represents that one which, with so many birds, never does hatch, but is addled (as I suppose) from the beginning.* If such be the case, it is perhaps possible that the birds, by their own sensations, may detect the want of life in the egg, or know, from previous experience—which, however, must first have been gained—that there is never more than one chick hatched. Yet even if the desertion could be thus explained, there would still be the bad egg to account for, so that it seems more probable that the whole matter is under the guidance of some larger and more impersonal law. That, to procure one chick, two eggs should annually be laid, is certainly a waste of energy, and it is therefore interesting, as suggesting that natural selection is in process of getting rid of this waste, that out of the two nests of

* In this supposition I was correct. See *post*.

this species which have come under my observation, here in Iceland, one contained a single egg* only, which had been sat upon for some time. It seems probable, therefore, that, in course of time, one egg only will be laid by the Great Northern Diver, as one might expect of a bird which has only one chick. And it is curious that the Red-throated Diver also seems travelling in this direction, for though it lays two or more eggs, which normally represent as many chicks, yet of these two (three is rare, but I have seen it) one very commonly dies, sufficiently so, in fact, for an authorised "watcher" of this species to have expressed the fact by saying, generally, that the chicks "dwindled." And this word, which was used in reference to the actual dying, as well as consequent diminution of the family, is applicable also to the process of it, the chick that is fated not to survive, being born, apparently, with a want of vitality which shows itself, from the very first, in a disposition to sit on the bank, for a longer and longer time before coming into the water (where alone it is fed) and to return to it, again, in a shorter and shorter time, till, at last, it is found lying dead there. Thus these two species show a chain of progression from a larger, yet small, family, to the smallest possible, the earlier links of which, only, have been passed through by the one, whilst the other has reached the last of them, which, however, has not yet become fixed. The links, as I have seen them, but with two probable intermediate ones † added, are (1) three eggs and three chicks, (2) three eggs and two chicks only, owing to the early death of one out of the three, (3) three eggs and two chicks only, owing to one egg not hatching, (4) two eggs and two chicks, (5) two eggs and one chick only, owing to the early death of the other one, (6) two eggs and one chick only, owing to one of the two eggs not hatching, (7) the family of one only, egg and chick. Some may think, perhaps, that this is counting the links of the chain from the wrong end, and that the Diver family has increased instead of diminishing; but I cannot suppose that any egg or any chick would be, at first, and as the usual thing, infertile or unable to

* I ascertained that this was so from the beginning.

† (2) and (3) namely. Of course one cannot tell how many eggs were normally laid when the process which I have suggested, and to some extent observed, commenced

live. These are not stages in an upward road. I feel sure that the process has been the other way, and think, moreover, that I can see a reason for it. During the spring of 1913 I watched, continuously and from day to day, the domestic economy of a pair of Red-throated Divers.* One of the two chicks died in the way I have described, but, even after this, the surviving one, that had now two parents to attend to it, was fed by them at very long intervals. One must suppose that it got enough, but, with anything like a struggle, two would be less likely to, so that, as one robust chick is better than two weakly ones, it would be for the benefit of the species to have this change brought about. This would be all the more the case because, as here implied, it is the habit of the parents, when there are two chicks, each to take charge of one of them, and, as they then separate, this would prevent either chick from benefiting at the expense of the other and less hardy one, which would be the same principle, but less effectively applied. It is indeed possible that the one chick, in the instance observed by me, died because the sole parent in whose charge it was did not sufficiently nourish it, but it did not appear to me to be more neglectful in this respect than was the other. On the other hand, the lesser activity of the chick that succumbed—its more lethargic ways †—was noticeable from the beginning, and seemed to be the governing factor. I cannot myself think of a quite satisfactory explanation why the chicks of these Divers should be fed at such long intervals, but the grown birds have themselves to cater for, as well as their young, and the impartial law of natural selection will not more have favoured the efforts of the bird to catch fish than of the fish to avoid being caught. It may be a hard struggle, and should the food supply ever run short, a single year might see the death, through starvation, of a large number of chicks. Obviously, therefore, one chick that was tended by both its parents would have double the chance of surviving that either of the two tended by one of them only would have, whilst, at the same time, the burden upon each of the parents would be only half as great. I do not know whether, owing to long habit, become stereotyped, the young of the Red-throated Diver are fed on one kind of fish

* See *résumé* of my notes in 'Wild Life' for 1914.

† See *ante*, p. 268.

only, but I have never myself seen anything but sand-eels brought in to them. In no instance were they fed with fish from the loch on which they were established, but only from the sea.

If we suppose that natural selection has, in some cases, lessened the number of young birds in a family, by favouring those couples (and, through them, the race) to whom a sickly child was born (so long, of course, as it died), then, on the principle, "*Bis dat qui cito dat*," we can understand this sickliness showing itself at an earlier and earlier age, till, at last, the dissolution took place within the egg. Here, then, may be the explanation of a fact that is not the less one because reference is so seldom made to it, viz. that one egg of a sitting is often addled. I believe this to be normal with the Dabchick, as probably also with the Curlew.* With their brood of four—which I think is the ordinary one—well advanced, there was an unhatched egg in the nest of the Merlins that I have been watching, whilst, from what I can learn, Sea-Eagles here have usually but a single eaglet. I have made the same observation with various other species of birds.

Birds may derive their fecundity—which originally, perhaps, was greater and more general—from their reptilian ancestry, but when both the eggs and the hatched young require little or no attention, as is, speaking generally, the case with reptiles, large families are not an incumbrance. With the advent, or increase, of personal concern for the offspring, however, this is no longer the case. The burden now begins to make itself felt, and may for various reasons, become detrimental. The gradual lessening of it, therefore, where this is the case, through the action of natural selection, would not be at all surprising. Such a result might be brought about in a variety of ways, including the destruction of the egg by the parent bird itself—a thing which I have, in one case seen, and, in others, had to infer.

It would seem that whilst some of the Phalaropes are sitting, others have either yet to lay, or have not laid all their eggs. The last might account equally for the attentions still paid by the males to the females and the refusal of them by the latter. The brusquerie of the courtship would also be in accordance with the later stage of things, as may be seen in all birds, I think, and notably in the male Pheasant, who, in the earlier

* Dr. Heatherley has noticed this.

part of the love-season, courts the hen with a most elaborate display, whereas, later on, he makes hardly more ceremony with her (nor she with him) than does the Domestic Cock in the barn-yard—"Sic transit gloria *amoris*." A later stage still, is masculine languidity, under the influence of which the female is apt to become the wooer, as I have particularly noted with Gulls. For the male Red-necked Phalarope, however, though I have seen all too little of his courting habits, yet this afternoon's observations have given me an insight into his real character, and it seems to me that, in this demure, plain-looking little husband, we have one of the "freckest" lads in all bird-land. Who was it thought he was hen-pecked?—or was that his poor brother, the Grey Phalarope, who, however, may perhaps have revelations of his own to make?

(To be continued.)

NOTES AND QUERIES.

AVES.

Bird Notes from Bury St. Edmunds.—The Tawny Owls returned to our church-tower this spring for the tenth successive year, but the nest was spoiled in a gale at the end of March. Some rubbish was blown into the nest, breaking one of the two eggs, and the birds deserted. But the pair which always breed in our own grounds were more successful. Four eggs were laid in a nest-box, all of which were hatched. One Owlet died in the nest when nearly full-grown, but the others got away safely, and we hear them every night. The hen-bird was very tame when sitting, and would allow us to put a ladder up and look at her without moving. All mice caught in the house were her perquisites, and on one of my visits I dropped three mice in succession into her box, but she took no notice. In the way of food I found in the box a very good specimen of *Mus flavicollis* and the remains of a Missel-Thrush. A Stock-Dove laid two eggs in the same place in the church-tower which the Owl had occupied, but forsook them. In our nest-boxes we have had the Great Tit, Blue-Tit, Coal-Tit, Tree-Sparrow, and Starling. I have not done much nest-hunting this year, but have found three Cuckoos' eggs, which were certainly laid by three different birds. Two were in Hedge-Sparrows' nests, one of which was exactly like a typical egg of the Whitethroat, and the third in a Reed-Warbler's nest. This was one of the reddish-brown "zoned" type, which one could almost match with some eggs of the Tree-Pipit. My own belief (for what it is worth) is that the "assimilation" of the Cuckoo's egg to that of the foster-parents is entirely accidental, and that there are many "Cuckoo clutches" in collections to which the egg of the Cuckoo does not really belong. Quite by accident one day I produced a most accurate imitation of the "water-bubbling" cry of the hen Cuckoo, when filling an ordinary medicine-bottle from a pail of water. The resemblance was most striking, but repeated efforts failed to get quite such a good effect again. Cuckoos have been more abundant this year than we ever remember; Swallows and Martins perhaps rather above the average, but most of the other summer migrants rather below it. For the first time in my life this year I have seen a Blackbird's nest with six large young ones, and of seven clutches of Yellow Bunting I have found two were "fives," which in our district

is very rare. A few weeks ago I had the pleasure of showing a young friend a Lesser Spotted Woodpecker in the very act of "jarring," and he was able to get a good view of the bird through my field-glasses. The remarks of the late Professor Newton on this subject ('Yarrell,' ed. IV, vol. ii, pp. 477, 478) are well worth reading, and his most captious critic could hardly question their accuracy. Certainly the noise is very loud for so small a bird, and one day, when my daughter was riding past the old beech frequented by the Woodpecker, it quite startled her horse.—JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds).

Yellow-skinned Variety of Jackdaw.—On June 22nd a friend of mine shot and sent me a curious variety of the Jackdaw. On taking off the skin ready for mounting it, I found this was of a deep yellow colour from the base of the beak to the root of the tail; both inside and out were yellow, similar to the colour of the skin of some domestic fowls when plucked ready for the oven. The beak is a fine yellow from point to base, making the bird look like a fine old cock Blackbird; the legs and feet are also pied black and yellow, similar to the legs and feet of the Pomatorhine Skua. The eyelids are also edged with yellow. The centre of the crown of the head is black, but all round the black is a fine broad margin of pure white, including the feathers that cover the nostrils; this white extends to the bottom side of the eyelids. There is one grey feather on each side of the wings and two or three on the rump. I have six other varieties of the Jackdaw, but this one is very different from the others. The bird under notice was killed close to Mansfield.—WILLIAM DAWS (Mansfield, Notts.).

Habits of the Cuckoo.—On May 29th last I found a nest of the Tree-Pipit containing three eggs, also two eggs of the Cuckoo: the Tree-Pipit's eggs were slightly incubated, whilst the Cuckoo's eggs were fresh; this proves that the Cuckoo's eggs were deposited after the Tree-Pipit had commenced incubation. I once found a nest of the Chaffinch in ivy on a wall, about 8 ft. from the ground, containing only a Cuckoo's egg; two days after, the egg was still alone in the nest, and I took it; one can, of course, surmise, as Mr. J. Steele Elliott points out ('Zool.,' p. 232), that the Cuckoo located the nest when it contained eggs of the Chaffinch and that on returning with her egg she found the nest empty; one can also surmise that the Cuckoo deposited her egg in the empty nest without having seen eggs of the foster-parent. The following would be a possible, and at the same

time a probable solution of what happened: that the Cuckoo located the nest when it contained one egg, then, selecting the nest for her own egg, threw out the egg of the Chaffinch. The Chaffinches having discovered their first egg taken, forsook; this is well known amongst us all, that birds having their first eggs taken, often, I will not say always, forsake; then the Cuckoo, returning later with her egg, placed it in the empty nest. I found a Blackcap's nest a few years ago in a stone-quarry a little south-east of Wells, containing a Cuckoo's egg and four of the foster-parent, and underneath the nest, stuck in the brambles, was another egg of the Blackcap, which helps to prove that the Cuckoo often ejects one egg of the dupe, especially if there are five; but I have often found a Cuckoo's egg, with five others, in the nest.—STANLEY LEWIS (Wells, Somerset).

A Pair of Buzzards with two Nests.—Early last May I came across an instance of a pair of Buzzards building, or at least occupying, two nests before laying. Both nests were situated amidst beautiful scenery in a glen-side wood, in oak trees; one nest was a perfectly new one, the other was an old one remodelled. Both were edged around with fresh green ivy sprays. The eggs were laid in the new nest, which, as far as I know, now contains young ones, as the female was sitting closely, so I was informed, on May 26th.—STANLEY LEWIS.

Greenfinches occupying Blackbird's old Nest.—On June 10th last I found a Greenfinch's nest with five eggs built in the cup of an old Blackbird's nest in ivy, at Croscombe, near Wells; the nest was well down below the level of the Blackbird's and could not be easily seen. The nesting-site is very unusual and the eggs also are unusual, being a nice cream-coloured set with a few very faint spots on the larger end.—STANLEY LEWIS.

Cuckoo's Egg in Unfinished Nest of Goldcrest.—With further reference to the habit of the Cuckoo dealt with by Mr. J. Steele Elliott in the 'Zoologist' (June), the following incident might be worth recording. On June 10th this year I found a Cuckoo's egg in the nest of a Goldcrest, built in the usual situation at the end of one of the lower sprays of a big Douglas fir. There was only this one egg, and the fact that the nest was unfinished proves conclusively that in this case at least the Cuckoo inserted her egg in a nest that had not yet held its rightful eggs. The nest was, in fact, one of the unlined structures that are not infrequently to be found in the vicinity

of tenanted Goldcrest's nests, and which, by reason of their somewhat looser, untidy construction and unfinished condition, I take to be the equivalent of the "cock's nest" of the common Wren. The moss, etc., of the nest was so loosely cohering that the heavy egg of the Cuckoo was deeply embedded, although it proved to be quite freshly laid. Owing to the position of the nest, the insertion of the egg must have been a matter of some little trouble. Further, the tree was situated in the interior of a stand of mixed larch and fir within a large oak-wood. Both these facts suggest discrimination on the part of the Cuckoo, however much at fault the choice may have been. —Edwin L. Wood (Harrow).

Notes on the Laying of the Cuckoo.—Mr. J. Steele Elliott (*ante*, p. 232), referring to my note in the 'Zoologist,' p. 153, 1916, relative to the Cuckoo sometimes laying its eggs in empty nests, implies, and quite rightly, that such nests may have had the egg or eggs of their rightful owners taken, and therefore the above note does not affect the point of his query ('Zoologist,' p. 317, 1915). There can, I think, be no doubt that the Cuckoos do occasionally, and perhaps frequently, lay in empty nests which have never previously contained any egg or eggs of the owner of such nests. Speaking from personal observation, most of the Cuckoo eggs I have found have been laid in the nest of the dupe when about the third egg had been laid. The following instances, among others, may be cited as bearing on the nature of Mr. Elliott's inquiry. In the 'Countryside' for May 19th, 1906, Mr. Pearce records having found four nests of the Reed-Warbler, each of which contained a Cuckoo's egg. In one nest the egg of the Cuckoo had been placed before the nest was finished, but still the birds continued building, and when the first egg of the rightful owner was laid the lining of the nest almost covered the cuckoo's egg. Another correspondent of the same journal writes in the September number, 1906, that he has known of two instances in which the Cuckoo's egg was deposited several days before the nest of the dupe was complete; and in one instance the Cuckoo's egg was woven into the lining of a Hedge-Sparrow's nest, after which she deposited her eggs. One writer even goes so far as to say that the Cuckoo's eggs which he has found have in every case been deposited before the rightful occupant's eggs. Another correspondent in the 'Countryside' speaks of a nest of the Pied Wagtail having been but barely finished when a Cuckoo's egg was deposited, and it was two clear days before the first egg of the Wagtail was laid. I could quote a number of other cases in which the Cuckoo's egg had been laid in empty nests,

but whether previously the nests had been robbed it would perhaps be difficult to prove.—E. P. Butterfield.

First Nesting of Grasshopper-Warbler and Chiffchaff near Bingley.—To a lover of birds who has spent more than half a century in his leisure hours on moor and fell and in the woods which surround his native village, the occurrence of a fresh bird, especially for breeding purposes, is always an interesting event. Such an one occurred in this district last year (1915). Mr. S. Longbottom, of Bingley, under date of May 24th, 1915, wrote me that a Grasshopper-Warbler was building a nest in the Prince of Wales Park, Bingley, and another friend wrote about the same time informing me of the arrival of one near Hebden Bridge, but the nest of the latter was never found. I first heard this bird in Upper Wharfedale on the moor about forty years ago; previous to this it had been heard by two Bradford naturalists, Messrs. Carter and Firth, on the edge of the moor above Bingley, and a friend of mine, who now resides in California, formerly informed me of its occurrence near Thornton, Bradford, and it has probably occurred in two, if not three, other instances in this immediate neighbourhood; and in other parts of Airedale it is reported from Skipton, Leeds, and Adel (Nelson).

On May 30th Mr. Sam Longbottom, of Bingley, took me to see the Grasshopper-Warbler's nest mentioned above built in Prince of Wales Park. The nest contained five eggs and was built amongst tall grass, not quite so cunningly concealed as I had expected, in a rough part near the highway leading from Bingley to Eldwick, this part of the park being little used by the public. When we approached the nest the old bird flew off into an elderberry tree near by and crept stealthily away—more like a mouse than a bird—and never took long flights at a time, and these movements were repeated when I visited the nest on June 3rd, on which date the nest had six eggs. On June 12th the nest contained four young and two eggs, and on June 13th all the eggs were hatched, which took a little longer time in incubation than I thought would be the case. The young left the nest on June 23rd; one young bird actually left the nest on June 22nd.

After May 24th, when the bird or birds were building, Mr. Longbottom informed me that the bird ceased singing, and was not heard again until June 25th, when the park-keeper heard it again, but it ceased again after June 28th. On July 18th Mr. Longbottom found a second nest with six eggs within about forty yards from the first nest; four eggs were hatched on July 21st, and on July 23rd all the eggs were hatched out. On July 31st all the young left the nest,

and on the following day the male recommenced singing, but although Mr. Longbottom paid frequent visits almost to the end of August he did not hear its song again. The above record is interesting because it establishes the fact that this species, occasionally if not frequently, is double-brooded; and also for the fact that the male ceases to sing, at least during the incubation and rearing of its young, and the short period between the commencement of the nest and the young leaving the nest. It seems strange that after two broods were hatched and got off at Bingley last year, the bird should be absent altogether from the district this year (1916), but after all this is only in accordance with what we know of its habits in other parts of its range in Britain. In Yorkshire it is erratically and but sparsely distributed, nowhere abundant or even common for many years in succession except in a very few localities.

The Chiffchaff is such a common and general breeding species in England that most ornithologists may be surprised that the fact should be recorded here, but the first instance of this species nesting in this district came to my notice on June 14th last. Mr. Longbottom, of Bingley, came to my Eldwick home on the 11th instant, and said he had heard what he took to be a Chiffchaff singing in Sir James Roberts' park near Saltaire, about half-a-mile away, and wished me to go and confirm or otherwise his determination. Of course I went immediately, and we did not wait long before I both heard and saw the bird, which was undoubtedly a Chiffchaff. It was singing on the edge of the park, and Mr. Longbottom had been listening to its song and trying to find its nest for three hours, but had not succeeded, and we both tried for over an hour without success and then left. On June 14th I met Mr. Longbottom again by appointment at the same place, and he informed me that the Chiffchaff was not singing so freely at its old quarters, but had shifted about a hundred yards away and had been singing mostly nearer the north lodge. On visiting the north lodge entrance the male bird was singing, and on watching the bird for some ten or twenty minutes the female appeared, and on looking over soon after I saw the female with some building-material in her mouth, which she took to a spot covered by ivy about six yards from our position. We waited some, perhaps ten, minutes, and she was taking building-material every few seconds. On June 16th I went to the nest, which was complete but contained no egg. On June 18th the nest had one egg, on the 21st four eggs, and on the 25th five eggs, its full clutch, I presumed. The nest is larger than a Willow-Warbler's with a larger hole for entrance, and is not so artfully concealed. I think this must

be this bird's second nest. Possibly its first nest might have been somewhere near where it was singing on the 11th instant. This is the first instance I have known of its nesting in this immediate neighbourhood. I have several times met with it here on migration in early April, and I have heard it singing in the breeding season, but once only, near Barden Town in Wharfedale; and once a boy brought me a clutch of eggs which he said he had taken in Bingley Wood, which looked very like those of a Chiffchaff. In North-west Yorkshire it is an extremely rare breeding species, in many other parts of Yorkshire it is moderately common, and in some places it may be said to be quite numerous.—E. P. Butterfield.

Further Notes on Newton's Statements on Birds.—Referring to Mr. Harvie Brown's remarks (see 'Zoologist,' p. 235, 1916), I fully agree in the main. I have always recognised that birds vary, and vary widely in some cases, in their habits in their distributional range, and what I have wanted to point out in my notes on Newton's great work, his 'Dictionary of Birds,' has been that Newton has not sufficiently recognised this fact, and consequently his statements are much too absolute in many instances.

To take one case mentioned by Mr. Harvie Brown. The Stonechat, he remarks, is a bird which we in Scotland may well designate "not uncommon, but locally dispersed, varying greatly in numbers and nowhere what can be called very abundant save in a few favoured localities in, say, 1900. But what it may be say ten, twenty, thirty, or more years later it is not easy to say!" In Newton's Dictionary it is stated that this species is a "conspicuous object on almost every furze-grown heath or common in the British Islands"—a statement which, I maintain, is not in consonance with what we now know of its status. In many, indeed in most parts of Yorkshire and other parts of Britain where there are furze-grown heaths or commons it is extremely scarce, if not altogether absent; and its status has not changed for the last forty, if not fifty, years. I think when Newton states that the Spotted Flycatcher seldom arrives in the British Islands before the latter part of May, this can only apply to a very limited portion of the area of Britain; and to a lesser degree these remarks apply to the arrival in its breeding-haunts of the Common Sandpiper. In most of the counties in England I think the Sandpiper will arrive before May. There are other statements made by the Professor which it would be dangerous to apply to the whole of Britain, such as his statement that the Swift is the swiftest-flying bird in Britain; and many of his statements regarding the habits of

the Cuckoo are not in accordance with well-known facts throughout its range in Britain.—E. P. Butterfield.

INSECTA.

Hornets in Church.—Sunday, May 21st, was a very hot day, and our morning congregation was rather disturbed by the appearance of three large Hornets, which had doubtless made the church their winter quarters. They were not very lively, and one was easily killed by a choir-boy and another by a devout lady in the nave, while the third was found dead in the church a few days later. A good many queen Wasps have been killed this spring, but the death of three queen Hornets is a matter for congratulation, and I am keeping a look-out for any other which may try to use our nest-boxes.—Julian G. Tuck (Tostock Rectory, Bury St. Edmunds).

NOTICES OF NEW BOOKS, Etc.

The Practical Principles of Plain Photo-Micrography. By George West. Dundee: Campbell & Sons. 1916. 4*s.* 6*d.* net.

This small work of Mr. West, who is Lecturer in Botany at St. Andrew's University, will commend itself to zoologists as well as botanists, since the microscope and the delineation of what it shows are equally necessary to them, and indeed, a couple of the photographic illustrations deal with subjects from the animal kingdom. Mr. West's style is racy and incisive, and we are glad to see that, while recommending a little-known and very simple system of camera-less photo-micrography, he does not claim a universal superiority for the photograph over the drawing; in fact, "Pen and pencil still ahead" is one of his characteristic side-headings to the discussion of this part of the subject. This exactly coincides with our own experience in the study of animals entire; we have found the photograph, though invaluable in some ways, tantalisingly lacking in detail, and therefore often most unsuitable for students. Elsewhere we are glad to see Mr. West rejecting the idea that nothing good in the way of scientific instruments can be made outside Germany.

Errata.—On p. 218, line 24, and 226, line 29, for *perchopterus* read *percnopterus*; p. 228, line 24, for *Cerbillus hurricanæ* read *Gerbillus hurrianæ*; and for *Mus muiculus M. musculus.*

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THE ZOOLOGIST

No. 902.—August 15th, 1916.

HABIT-FORMATION IN A WASP (*VESPA* sp.).

By J. M. Dewar, M.D.

The ability of Arthropods to profit by experience is well known. Much, however, remains to be discovered regarding the mechanism and rate of learning. Towards the solution of these problems the present paper is a contribution. Experiments were made, in the month of June, on a queen Wasp* which had her nest in a bank of boulder-clay. Entering the exposed face of the clay through a hollow root, a long tunnel led obliquely backwards and to the right, to end in the wall of a disused rabbit-burrow. The paper nest was affixed to the end of the tunnel, and projected freely into the airway of the rabbit-burrow. The nest was distant about 40 cm. from the plane of entrance to the burrow, and was visible to the human eye at a distance of from three to five metres, according to the intensity of the light. The entrances to the tunnel and the rabbit-burrow were about 50 cm. apart. A nest from the same locality, but well removed from the scene of the observations, contained nothing but eggs and grubs; and such appeared also to be the condition of the nest of the experiments, though it was not opened up to make sure of its state. During the whole period of the observations nothing occurred to raise a doubt as to the identity of the Wasp visiting the nest.

* Probably *Vespa germanica*, F. The identification rests solely on the markings of the dorsum of the abdomen.

Before the experiments began, a note was made of the general habits. The Wasp always used the tunnel in going to and from the nest. She returned at top speed from the feeding-grounds, and bolted faultlessly into the tunnel, save on rare occasions, when she erred by a few centimetres. The Wasp then hovered for a second or two, at a short distance from the face, until she found the tunnel. Locality studies were not made on departure from the tunnel. The periods of absence ranged from three or four up to twenty minutes.

The method used in the experiments consisted of blocking the entrance to the tunnel with a plug of clay during the absence of the Wasp, and then recording the time elapsing from the moment of the Wasp's arrival in front of the plug until the moment (approximate) she passed through the entrance of the rabbit-burrow at each trial. The times were taken with a stop-watch, excepting at the first three trials. The plug did not prove to be of a very suitable material, the clay crumbling to pieces sooner or later, when a new plug was required. The defect had a real bearing on the results, but nothing else was available at the time. Trials were given on four days within a period of eight days, the last series being a test for retention. It was hoped to form a new habit of going and coming by the rabbit-burrow by retaining the plug constantly in the tunnel, but an hour was lost at the first attempt, while the Wasp, as it subsequently turned out, was engaged in breaking down the plug from the inside of the tunnel. The plug was, therefore, removed from the tunnel at each trial as soon as the Wasp passed into the rabbit-burrow. The Wasp discovered the road to the nest through the rabbit-burrow at the first trial with the plug. At the second trial she succeeded in breaking up the plug, and entered the nest in the normal way by the tunnel. At the third and subsequent trials she was compelled to reach the nest by way of the rabbit-burrow. The times recorded are shown in the table.

The first ten trials were the most interesting of the series, as within them nearly the whole of the learning process was contained. The ten minutes of the first trial were consumed by locality-studies of the immediate neighbourhood of the plug (these studies are here called locality-studies, as they in no way differed from the ordinary locality-study made by the Wasp on

LEARNING OF WASP.

(The times are given in seconds.)

Trials.	Days. 1.	3.	4.	8.
1	About 600	48	3	9
2	Broke plug	25	22	7
3	About 240	2	10	27
4	368	3	2	6
5	66	15	2	2
6	26	16	3	—
7	21	10	3	—
8	20	27	$\frac{4}{5}$	—
9	7	4	2	—
10	16	9	$1\frac{1}{5}$	—
11	—	16	2	—
12	—	7	13	—
13	—	$1\frac{2}{5}$	36	—
14	—	3	7	—
15	—	4	2	—
16	—	4	5	—
17	—	$\frac{4}{5}$	—	—
18	—	10	—	—
19	—	2	—	—
20	—	$1\frac{1}{5}$	—	—

her departure from the nest), in walking over and digging at the plug, and in high-speed random flights along the face of the clay to right and left for a distance of about 200 cm. each way. At the last of these she passed closely across the entrance to the rabbit-burrow, alighted, and walked in to the nest. In the preceding random movements the Wasp passed the burrow at a distance of about 30 cm., and gave no sign of a positive reaction to the nest. In the random flights of succeeding trials, before the new motor-habit was properly formed, she passed the burrow at a similar distance without giving an obvious sign of reaction to the nest, so that she reacted positively at a distance of 40 to 50 cm., but not at 70 cm., to a nest which was visible to the human eye at a distance of at least 300 cm.

As a result of the first experience, high-speed random flight, or

indeed movement of any kind to the left, was eliminated from the succeeding trials, with the exception of the first trial on the third day, when an abortive high-speed random flight of a few centimetres to the left was once observed. High-speed random flights to the right frequently recurred in the subsequent trials. The experience demonstrates the ease with which the Wasp acquired and retained "direction." Not so, however, the formation of the new motor-habit in all its details. Eight more trials were required to bring the new habit towards a fair degree of perfection, and the factors of the learning process were obviously different from the high-speed random flight.

In the third trial (the second was abortive) the Wasp, after hovering before and walking all over the plug, drifted slowly to the right, head-on to the clay face, and alighted to explore every blind pocket in the clay in the plane of the random flights of the first trial. In this way she arrived at and entered the rabbit-burrow. In the following trials she spent less time in examining the plug and gradually reduced the number of blind pockets to be explored on the way, until at the seventh trial the examination of these pockets was entirely eliminated for good. The ninth trial was distinguished by the appearance of a new attitude. While drifting to the right from the plug to the rabbit-burrow, the Wasp no longer squarely faced the clay, but inclined the long axis of the body obliquely to the right, so that the head looked half towards the bank and half towards the rabbit-burrow. In the tenth trial the Wasp, at first, drifted laterally to the right in front of the clay, and then, when half-way, abruptly turned at right angles and flew, head-on, at normal top speed into the rabbit-burrow. The plug was now almost a sufficient stimulus to release the requisite movements leading to the rabbit-burrow, and the sweeping curve of the air-line, followed in all the later trials from the plug into the rabbit-burrow, was well established.

In most of the trials on the third day, a short reaction to the plug induced the quick curving flight into the rabbit-burrow. Several of the trials given on this day showed in the time records apparent lapses on the part of the Wasp. These were due to the necessity of renewing or remodelling the plug of clay used to stop the tunnel. Interference with or renewal of the plug

always induced prolonged hovering before and alighting on the plug, with consequently large increases in the recorded times. In the ninth trial the Wasp returned from the feeding-grounds directly to the rabbit-burrow, in front of which she planed to and fro for a few moments. Though in the first trial the Wasp reacted positively to the nest when she was in exactly the same position, on the present occasion she failed to do so, and proceeded to the plug, where she hovered for a little and then flew quickly into the rabbit-burrow. The experience illustrates well the chain-reflex nature of the new habit which had been formed. The movements to be performed in traversing the rabbit-burrow to the nest could not now be released at the entrance to the burrow. The stimulus of the plug was a necessary link in the chain.

The trials given on the fourth day did not differ in general features from those given on the third. At the first and the eleventh trials the Wasp, after hovering before the plug, flew to the entrance of the rabbit-burrow, where she suddenly turned and flew back to the plug. There she hovered again before proceeding finally into the burrow. The twelfth trial was even more remarkable, in that the Wasp returned twice to the plug after reaching the entrance to the burrow. From the notes of these trials it is hard to tell whether the plug failed to give an adequate release of the movement into the burrow, or some new sensation derived from the unsatisfactory material of the plug produced a delayed inhibition of the movement and a compulsory return to the plug.

The trials of the eighth day showed perfect retention after an interval of about ninety hours. Following these retention trials, two returns were observed without the plug having been placed in the tunnel. In the first instance the persistence of habit and an absence of immediate reaction to the actual environment were demonstrated. The Wasp hovered before the tunnel as if the plug were still there. But at the second trial she came in at top speed and dived abruptly into the tunnel.

On leaving the nest the Wasp made locality-studies before the mouth of the tunnel after the first sixteen trials. Thereafter, no locality-studies occurred unless the plug had to be changed or remodelled. Whenever this was the case, the Wasp made a study of the locality. In the last two experiences of the eighth

day, without the use of the plug, the Wasp did not make locality-studies after leaving the nest. A prolonged hovering in front of the plug on arrival was correlated with an elaborate locality-study on departure.

Lubbock made similar experiments on Wasps. He fed the Wasps in a room, the nest being outside. The room had two windows, one nearer the nest being closed and the other open. A Wasp, probably a worker *Vespa germanica*, in going home went at first to the closed window. In the first three trials the Wasp had to be "put through the act" by being taken from the closed window and put out by the open window. In the fourth, fifth, and sixth trials it went first to the closed window, then out by the open window. In the seventh to the twenty-second trials the Wasp went directly to the open window. Another Wasp learned the way in a single day and was given fifty trials in five hours. Yet on the next day it went repeatedly to the closed window. Lastly, a worker, probably *Vespa vulgaris*, learned the correct road in five trials, and was given twenty-five trials altogether. The next day it was not so sure of the way, going to the closed window over and over again.*

The experiments, apparently the only ones of the kind that have been applied to Wasps, show for the workers used by Lubbock a slower rate of learning than that of the queen Wasp of the experiments described in the present paper, and the results for retention are much inferior. These differences may, in part at least, be accounted for by the necessity in Lubbock's experiments of breaking up the strong innate tendency of the Wasp to go towards the light, and by preference the lighted area nearer to its nest when a choice of two lighted areas, one near the nest and the other far from the nest, is exhibited. The difficulty was even more marked in the case of a Bee which was admitted by Lubbock to a room through a door at the back of the hive for the purpose of being fed, and which had great difficulty in finding its way back through the postern door of the hive. Here a tendency to go away from the light had to be established, and there was still considerable difficulty at the ninth trial.† The experiments

* Lubbock, 'Ants, Bees, and Wasps,' p. 415 *et seq.*, 9th Ed., 1888. Also a *résumé* in Romanes, 'Animal Intelligence,' p. 145 *et seq.*

† Lubbock, *loc. cit.* p. 274. Romanes, *loc. cit.*, p. 181.

on the queen Wasp were conducted in the open air, the lighting conditions remained unaltered, and the instinctive modes of response to specific sensory stimuli were not affected.

It is hardly worth while attempting to draw any conclusions from a curve of learning based on the reaction times. The learning curve shows the usual rapid initial descent and subsequent irregularities, the most of which may readily be explained as being due to the variable nature of the plug used to close the entrance of the burrow. The method of learning was obviously trial and error or, as some prefer it, trial and success. When the normal sequence of motor activities was interrupted by the presence of the plug, the motor energy of the Wasp liberated itself in random movements which were of two kinds, each kind having a different result. The assumption could not, however, be justified that the two modes of response always function differently in the Wasp. In the present instance the distinctive ends of the two types of movement were clearly the result of accident. The high-speed random flights produced no more than the proper direction by means of an accidental success. The slow exploratory random movements gave position, and eventually, by the elimination of useless movements, established an habitual air-line from the plug to the nest. The Wasp had the power to modify its behaviour in a regulatory way, and she had retention. The Wasp had associative memory as defined by Loeb,* and intelligence according to the definition of Jennings.† The Wasp was able to form an association of a simple kind. She did not connect an old motor-habit with a new sensory stimulus, but formed a new motor-habit in response to a new sensory stimulus. Strictly, one may doubt whether an association was formed at all. There is a difference between the association of a particular movement with a given sensory stimulus and the release of a random, though successful, movement by an adequate sensory cue. The former suggests activity; the latter passiveness. The former has an imaginal or perceptual implication; the latter is purely physiological and explicit. The evidence is altogether in favour of the sufficiency of the second explanation to account for the reactions of the Wasp

* Loeb, 'Comparative Physiology of the Brain,' p. 213, 1900.

† Jennings, 'Behaviour of the Lower Organisms,' p. 333 *et seq.*, 1906.

under trial. The connection between sensation and response was immediate. There was no delay. The accidental success of the first trial did not establish a new road to the nest. In other respects, such as the slow elimination of useless movements, especially in the beginning of each reaction, the results do not favour the presence of images nor ideas, nor even of the sensory thought described by Hunter.* There was evidently sensation, but not perception. Hence the word retention† is to be preferred to the word memory as a term for the mechanism of the more or less permanent modifications of behaviour in the Wasp. The conclusion is reached that the learning of the Wasp did not transcend the sensori-motor level, and that images or ideas were not elements essential to an explanation of the observed reactions.

From the absence of locality-studies prior to the start of the experiments, the discontinuance of the studies after the plug was left out of the tunnel, and their cessation after the sixteenth trial excepting when the plug had to be renewed or remodelled, from the similarity of the behaviour in front of the plug on arrival from the feeding grounds, and the locality studies made before the tunnel on departure from the nest, it may be surmised that the locality study is a compulsory reaction to more or less novel environmental stimuli, having a biological significance to the Wasp, rather than a means directed towards securing an accurate return to the point of departure. The locality-study is certainly a feature of Aculeate behaviour deserving of a far more critical examination than any the study has hitherto received.

* Hunter, "The Delayed Reaction in Animals and Children," 'Behaviour Monographs,' vol. 2, No. 1, 1913.

† Watson, 'Behaviour,' p. 241, 1914.

ON THE EDUCABILITY OF THREE ROCKLINGS AND A SEA-BULLHEAD.

By H. N. Milligan.

Precise notes are rarely made upon the behaviour of common sea-shore fishes during the first few days of their residence in aquaria, or upon the length of time which may elapse before they begin to look for and to accept food from their owner. Such detailed records (not general statements, which are nearly useless) will be of great value when a sufficient volume of them has been obtained. Attention has already been drawn to this subject in the 'Zoologist' ("Tameness in Several Blennies" and "Tameness in a Sea-Bullhead," 1915, pp. 358–9; "Educability of *Galathea strigosa*, 1916, pp. 297–8), and I should now like to describe additional examples of educability in three individuals of the Five-bearded Rockling (*Motella mustela*) and in a Sea-Bullhead (*Cottus bubalis*). The statements contained in this paper are simply those of fact, and no attempt is made to express opinions. It may also be remarked that all the simple modifications of behaviour observed were such as sprung naturally out of the fishes' new environment, and the animals were not "taught" nor set "tasks" to perform.

(1) On October 9th, 1915, a Rockling of three and a half inches in length, obtained from Weymouth, was placed in an aquarium. The tank contained about twenty-seven gallons of water and a mass of rockwork which provided convenient hiding places for the fish. The Rockling, as is usual with individuals of this species, remained almost motionless and almost completely hidden (during the daytime at least) in recesses of the rocks during the first few days of its captivity. On the morning of October 14th, however, when its head was observed to be projecting slightly from the rocks, the fish was induced to take, apparently without fear, a piece of raw beef from the wooden feeding-forceps. On the morning of the 15th (that is, during the sixth day of captivity), when the fish was lying fully exposed on the rocks, the food-tainted forceps were gently laid against its snout. The fish at once began to examine the forceps, swimming

round and round them and rubbing the snout and fore part of its body upon them, in the characteristically eager manner of a hungry Rockling, which curiously suggests the rubbing of a cat round the leg of a person from whom it wishes for food or caresses. A piece of beef was now presented to the fish, and was eagerly taken. A few minutes later the Rockling was easily induced to follow the forceps to the surface of the water, where it took three successive pieces of beef from my fingers. From then until the death of the Rockling by accident on October 27th it was my daily custom with the forceps to entice the fish to come from its resting place amongst the rocks to the surface of the water to be fed. If my finger was rubbed on raw beef, fish, or mussel, and then placed in the water close to the rockling, the fish would anxiously press the snout and fore part of its body upon the finger, and move round it in the cat-like manner already mentioned.

(2) A Rockling of four and a half inches in length, from Weymouth, was placed in an aquarium on November 9th, 1915. It hid itself completely amongst the rocks until the 15th. On the morning of this day (that is, the sixth day of captivity) when its head could be seen at the entrance to the hole in which it had made its home, it was offered a piece of mussel in the forceps. The Rockling seemed divided between hunger and fear, for it alternately approached close to and retreated from the food several successive times, finally taking alarm and dashing suddenly back into its resting place without eating the food. It continued to behave in this way until the morning of the 25th (the sixteenth day of captivity), when it took three successive pieces of mussel from the forceps, without much fear. By the twentieth day of captivity it had learned to come out of its retreat when the forceps were placed at the entrance. On the morning of December 1st (twenty-second day) a further advance in the education of the Rockling, suspected as early as November 27th (eighteenth day) but now rendered certain, was to be noted. It is necessary to illuminate the aquarium, which is in a shady though not dark place, by an electric lamp suspended over the tank, when the fishes are to be fed. On the morning of the twenty-second day it was observed that the sudden illumination of the tank, followed by movement of the surface of the water as

the forceps were dipped into it, caused the Rockling to dart excitedly out of its hole and swim eagerly about the tank. From that day (on which it first began to feed from my fingers) the illumination of the tank by any visitor who examined it was sufficient, providing the Rockling was not full fed, to bring the fish from its resting place; and this might happen several times in the course of an hour. It responded most certainly, however, to the illumination early in the morning, when it was hungry. By the fortieth day a further advance in the education of the Rockling could definitely be noted. It is my custom to introduce the forceps into the aquarium from one particular corner of the tank. It was now observed that when the fish left its hole to look for food it always travelled (round the walls) towards this corner, where it would swim to and fro, and upwards and downwards, in the water. Indeed, it was often the case that when the aquarium was approached with food in the morning, the Rockling was found to be waiting there. On January 18th, for example, the fish was found at 9.30 a.m. in the corner, moving excitedly to and fro, and it remained there until it was fed at 11.15 a.m., after which it retreated to its hiding place. By January 1st (fifty-third day) it could be noted that the Rockling, affected no doubt by the tranquillity of life in an aquarium in which there were no enemies except tiny Swimming-Crabs and small Opelet Sea-Anemones, displayed little or no alarm when it was given a tap with the forceps; a touch of the forceps during the first fifteen or twenty days of captivity would have caused the fish to dash to its hole; in January if it retreated at all it did so in a leisurely fashion. On January 18th (seventieth day) two Shore-Crabs were placed in the aquarium, but the presence of these fierce crustaceans did not deter the Rockling from waiting for food at the corner of the tank.

(3) A third Rockling, five inches in length, also from Weymouth, was placed along with the second Rockling on December 8th, 1915. It at once darted to the shelter of the rocks. On the morning of the 9th, when it was partly exposed amongst the rocks, it was offered a piece of mussel in the forceps, but this was refused with signs of fear. It was not until the morning of December 18th (tenth day) that it took pieces of mussel from the forceps, but on this day it also followed the

forceps through the water as though seeking for further food. By January 1st (twenty-fourth day) it had become accustomed to taking food from my fingers. On January 6th (twenty-ninth day) it was noted that the Rockling was awaiting food, along with the second Rockling, at the corner of the tank, and it continued to do this. Both Rocklings died in February.

In order that the importance of the foregoing facts may be appreciated it must be observed that the Five-bearded Rockling is an exceedingly timid nocturnal fish which dreads light and light-coloured surfaces. J. Stuart Thomson ("The Dorsal Vibratile Fin of the Rockling (*Motella*)," 'Quart. Journ. Micro. Sci.,' No. 229, vol. 58, N.S., September, 1912, p. 250) mentions that in his observations upon Rocklings it was necessary to keep even the light of a candle in a more or less shaded place.

On December 8th, 1915, a Sea-Bullhead (*Cottus bubalis*) of three and a half inches in length, from Weymouth, was placed in an aquarium which already contained several large individuals of the Goby (*Gobius paganellus*). It should here be remarked that the Sea-Bullhead finds food mainly by the sense of sight, whereas the Rockling finds food by touch, taste, and smell.

The Bullhead was at first very timid, and invariably retreated by swimming heavily and jerkily through the water when the forceps were placed close to its body. The fish lay for the greater part of the time partially embedded in the pebbles of the bottom, or clinging with its spreading pectoral fins to the vertical rockwork at the back of the aquarium. On the morning of December 10th (that is, during the second day of captivity) a piece of mussel, and afterwards a piece of raw beef, was offered to the Bullhead in the forceps, but the fish appeared to take no notice of the food, and swam away when the pieces of beef and mussel were thrown on the bottom close to its head. The Bullhead again refused beef and mussel on the 11th. On the morning of the 17th (ninth day) it took three successive pieces of beef which were thrown into the water, but it would not approach a piece which was held towards it in the forceps. The jerky movements of the Gobies, which are in the habit of darting rapidly out of their holes to seize food and then darting back again, probably added to the Bullhead's fear of the forceps. It

was not until December 27th (nineteenth day) that it could definitely be noted that the Bullhead had begun to associate the illumination of the aquarium, and subsequent introduction of the forceps into the water, with the advent of food. On December 28th, when the surface of the water was disturbed with the forceps, the Bullhead looked up with the characteristically scrutinising glance of this species of fish, and then excitedly snapped at fragments of seaweed which were caused to move by the agitated water. On the 31st (twenty-third day) the Bullhead approached, with unmistakable eagerness for food, the glass front of the aquarium, when the electric light was turned on and the glass tapped with the fingers; and then it swam in its usual heavy fashion to the surface of the water as though anticipating the introduction of food there. On January 5th (twenty-eighth day), when the light was turned on, the Bullhead darted to the surface and put its snout out of the water several times. It then retreated to the top of the rockwork, which is four inches from the surface. A finger was put into the water, with its tip just beneath the surface, and the Bullhead made several darts towards it. The fish then received pieces of mussel from my fingers. By this time the Bullhead had apparently lost all fear of human beings, and it seemed to be in no way alarmed—indeed, it scarcely noticed—a gentle thrust from a finger or from the forceps. On the morning of January 11th the fish would not trouble itself to move from a certain place until it had received several thrusts of increasing force from the forceps. On the 15th (thirty-eighth day) it darted to the glass, against which a piece of mussel was held; it then followed the food as it was slowly dragged up the glass to the surface; there the mussel was taken by the fish from my fingers. From about that date onwards, a few taps upon the glass, preceded or not by illumination of the tank, was sufficient to bring the Bullhead, if it had not been fed, eagerly to the front of the aquarium. The fish died in July, but before this time it had become so confident that it was sometimes possible to take it in the fingers for examination, but not, of course, to lift it out of the water.

HINDU ZOOLOGICAL BELIEFS.

By W. Rae Sherriffs,
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(Concluded from p. 259.)

Birds.—Commonest of all Indian birds is the Crow, which, in Madras, at any rate, is considered to at least equal the human population in number. As everyone knows, this wily bird always looks askance, and the Brahmin Crow (*Corvus splendens*) is thus believed to have only one eyeball, which, however, can move at will into either socket. To account for this remarkable ocular phenomenon the following tale is related:

One day, when Rama and Sita were exiles in the forest, Rama lay asleep with his head on Sita's lap, when a Crow, who was really Indra's son Jayantha, jealous of the sight, came and pecked at Sita's breast till it bled. Sita loved Rama so much that she would not move lest she should wake her lord. Shortly after, a drop of warm blood from the wound fell on Rama's face. He at once woke up, and, recognising the Crow, shot an arrow at him. Off flew the Crow, with the vengeful shaft in full pursuit; and the Crow in despair implored all the deities to save him, but in vain. Back he had to fly to Rama, and humbly ask for pardon, which was readily granted, but on one condition. "My arrow," said Rama, "must find its mark." This it did by removing one of the Crow's eyeballs. Yet for all that, the bird suffers little inconvenience, because the remaining eyeball can shift as required from the one orbit to the other.

The Crow is the vehicle of Saturn, who acts adversely upon everyone's life for a period of seven and a half years. Both these are worshipped by all every Saturday.

If a Crow takes up its position on the roof of your house and caws incessantly, then you know that a guest will arrive soon. In order to ascertain the nature of the expected visitor you say to the Crow, "If it is a friend who is coming to see us, then walk up and down, but if it is only another Crow that is to

arrive, then fly away at once." According as the Crow obeys your command, you know whom to await.

The Kite, Garuda (*Haliastur indus*), commonly called the Brahminy Kite because of its white head and neck, carries Vishnu. When you see it or hear it, cry "Krishna," and worship it. To hear its cry, which is a shrill, querulous whistle, is always lucky, and especially so on Sunday mornings.

The Hindu regards as lucky or the opposite many animals, according as you see them to your left or right. If you meet on your left the King-Crow (*Dicrurus*), Brahminy Kite (*Haliastur*), Quail, *Neophron*, Owl, *Varanus*, *Herpestes*, *Simia*, *Astur*, *Xantholæma*, Squirrel, or a Dog, then good will come to you, and *vice versâ*. Certain others—*Ardeola*, *Ceryle*, Crow, Crow-Pheasant, Parrot, Peacock, Common Fowl, *Calotes*, Spotted Deer, Civet Cat, Tiger, Fox, and Buffalo—when met on the right, are always a good omen. Some animals, if they cross your path, always bring bad luck—*cf.* Cat, Snake, Rabbit, or Hare. The following are always good to hear: the screech of the Owl, the squeak of the Shrew, the chanting of the Vedas, the braying of the Ass, the neighing of a Horse, and the flapping of a Dog's ears when it shakes its head; but wailing, the grunting of the Pig, and the crowing of the Cock denote evil.

Birds flying towards you are of good import, and so also is an approaching Cow, Bull, Horse, or Elephant.

The Swan (annam or humsam) is the carrier of Brahma. Long ago Brahma and Vishnu wished to find out which was the superior of them, and Shiva kindly consented and condescended to act as judge. When the two deities were ready for the contest, Shiva suddenly assumed gigantic proportions, his feet resting far below the under-world, while his head overtopped the highest clouds. Whichever of the competitors first discovered Shiva's head or feet was to be adjudged the superior. Vishnu at once assumed the form of a Boar, and began digging into the earth with his tusks in order to get at Shiva's feet. He soon gave up the attempt, but another form of this story asserts that he is digging away yet. Brahma, on the other hand, took the form of his vehicle, the Swan, and flew upwards to locate Shiva's head. As he mounted in the air there fell down a bract of the Screw-Pine (*Pandanus*), which up till then the god had worn round his head.

The Swan seized the bract, and with its consent came to earth, saying that he had found Shiva's head, for was not this very bract proof of that?

This humsam is the Indian emblem of discrimination. Just as this mythical Swan is able to distinguish between water and milk, and select only the milk from the mixture, so is the Indian student frequently exhorted to emulate the bird, and thus be able to discriminate in his studies between what is really of value to him and what will profit him nothing.

The Peacock is the favourite bird of Indra. It bears the god Subrahmanyam, while Saraswati is also depicted as riding upon it. It is the only bird that is said to rejoice at the coming of the rains.

King Sibi was famed for his virtue and charity. The gods resolved to try him. Agni became a Dove, while Indra changed himself into an Eagle. Pursued by the bird of prey, the poor Dove flew in terror to the king and implored his protection, which was at once granted. On hearing this, the Eagle at once protested to the king that he must not be deprived of his food. King Sibi then asked the Eagle to prefer some other request, which he promised to perform faithfully; whereupon the Eagle demanded a weight of the king's own flesh equivalent to that of the Dove, but the sacrifice had to be made willingly. To this atrocious demand the rajah assented. Scales were produced, but always when the king's flesh was just on the point of weighing down the bird, the latter's weight increased, until, when the last morsel was about to be removed from the royal body, Eagle and Dove took their proper forms, revealing themselves to the king, whom they warmly commended for his charity.

Screech-Owls are common in the plains of South India. The frequency of their cry is of great import. Once signifies news of death; twice, success in work; three times, gratification of desires; four times, dissension; five times, travel; six times, visits from a relative; seven times, loss; eight times, immediate news of death; nine times, all that is good; more than nine times, good luck.

The Chuckorah is a mythical bird mentioned in Indian poets. It was said to feed solely on moonbeams.

Jatayus, the king of the Vultures, attacked the ogre Ravana when he carried off Sita. The demon cut off a wing, but the bird lived just long enough to narrate to Rama all that had happened.

At Tiru Kalikundram, the hill of the sacred Vultures, several miles south of Madras, two well-known birds come daily to the temple to be fed at eleven o'clock in the forenoon by the priests. The temple is ancient, and for centuries past these birds (*Neophron*) are popularly believed to be rishis who leave Benares every morning, stay for lunch here, and then haste on to Rameswaram, which they reach at nightfall.

There are many Cuckoos in the plains, but the commonest is the Koel (*Eudynamis*), the call of which resembles the Tamil word "akka" (sister), and the belief is to the effect that a man once had two beautiful daughters, one of whom was accidentally drowned in the sacred Cauvery, and the other changed to this bird, which, when the river is in flood, still calls for her sister.

Mammals.—The white Bull is the steed of Shiva, the Buffalo that of Yama, the god of death. The Cow, of course, is a very sacred animal. It arose first from the milk-ocean and had a woman's face. Every Friday the Cow is worshipped, its body being dotted with red or yellow powder. Kamadhenu is the sacred or wishing Cow, the Cow of plenty, and was won by the sage Vasishta as a reward for his ascetic merit, but in reality it belonged to Indra.

Six men once conspired against the rishi Gautama. At their request Ganesa became an emaciated Cow, which angered the sage so that he struck it with a blade of grass, and to his horror killed the animal. Now, to slay a Brahmin or a Cow is the greatest sin possible for a Hindu, and the sage was plunged in remorse for his deed, but Shiva, knowing the artifice, purified him by pouring on him the waters of the Ganges from his ruddy locks.

The Horse, Uchaisrava, so called from the loudness of his neighings, arose from the churning of the milk-ocean. The sun's chariot is drawn by seven Horses, the seven prismatic colours, and it has only one wheel. Badaba is the Horse believed to live at the bottom of the sea. He bears a light in his forehead, which, at the end of the world, is to burn up every-

thing. The renowned Horse sacrifice (aswamedha) had its origin in this way. King Sagara had sixty thousand sons. He had performed ninety-nine horse sacrifices, and was desirous of completing the hundredth ; but Indra got jealous, because if the king did so, he would be his equal. Indra thereupon stole the Horse selected for this hundredth sacrifice, removed it to the underworld, and there tied it to the back of a rishi, Kapila, who was meditating. The king's sons searched everywhere on earth, but in vain, and soon convinced that the creature was not in the world, they began to dig down for it. When they saw the Horse tied to the sage, they blamed him for stealing it, and he, thus rudely interrupted in his pious meditations, merely opened his eyes on them and the glare reduced them all to ashes.

Many years afterwards, Bagirata, a descendant of King Sagara, learning of the fate of his ancestors and knowing that, since no funeral rites had been performed, their souls had not yet reached heaven, practised austerities and prayed to Brahma that the holy waters of the Ganges might descend and flow over their bones. His request was granted. The Ganges came down with such violence that the earth itself would have been washed away had not Shiva intercepted the flood in his matted hair. Ultimately, Ganga was allowed to flow gently to the lower regions, and whenever its waters covered the ashes of the departed, their souls reached bliss. This tale has given to the river the name Bagirathi.

The Horse Uchaisrava is Indra's steed also. Kalki, the last avatar of Vishnu, is yet to come, on a white Horse, to end the present kaliyuga (age).

The Spotted Deer (*Axis*) is mentioned in the *Ramayana*. When Ravana wished to carry off Sita, he sent his nephew in the form of a beautiful Stag, Maricha, to play before the hermitage, knowing full well that Sita's curiosity would certainly be aroused. As he planned, so everything came to pass. Rama went after the Stag to shoot it. Lakshmana, his brother, soon followed him, leaving alone and unprotected Sita, who was then seized and carried off by Ravana himself. Deer are always mentioned in any description of a forest. They are the type of gentleness and quietness, and for this reason women are compared to them. The chamara is a brush made of white hairs

from the Deer's tail, and used to keep flies off the god in the temple.

When sunshine and shower mingle, then the Fox is getting married—others, however, say it is the Tiger—and to see its face in the morning is a good thing.

A bad man may become a Dog in his next birth. When a Dog recollects his previous births, and all he did in them, then it is that he bays, especially on bright moonlight nights. Dogs are said to be able to see Yama, the god of death, and to howl at him.

The Cat is a pet of Sri Krishna, and must not be killed on this account. The Cat, furthermore, is the Tiger's uncle, and taught him everything he knew, save one trick—namely, how to climb trees. One day the two fell out, and the Cat saved its life by climbing a tree, which enraged the Tiger so much that he declared he would go even the length of eating the Cat's excrement, if so he might learn to climb trees. For this reason the Cat is ever so careful to always bury it, and the baffled Tiger is unable to climb yet.

Jambavan is the king of the Bears. Once Brahma happened to yawn rather deeply, when out came this animal, who was sent round the earth to proclaim by "tomtoming" that Vishnu was the lord of the three worlds, at the time when Vishnu was in the avatar of Vamana, the dwarf. Mount Mahameru happened to strike Jambavan on the knee, so to this day all Bears walk slightly lame. When anyone boasted of a great feat, then Jambavan declared that of course he could have done it much better had he not met with this accident which lamed him. "As old as Jambavan" is a Tamil saying.

A white Elephant is the vehicle of Indra, and is called "aira vata."* It arose from the milk-ocean. The Elephant can act as the mount of all the gods, and one is commonly kept in each big temple. In South India it is regarded as being very faithful, but also vindictive. It is believed to be in constant dread of ants entering its ears, and that explains why it is continually flapping them. The Elephant's gait is thought slow and majestic, and it is a compliment if you are said to walk like one. According to one story, eight Elephants stand on a Turtle, supporting this

* It is also known as Indravat, and its trunk is the water-spout.

earth of ours, and face the eight chief points of the compass. Ravana once fought with them, and their tusks, breaking off, stuck in his breast, where he decorated them with rubies and diamonds.

The Elephant god, or belly-god, called Ganesa, Vigneswara, Ganipathi, or Pillayer, is the son of Shiva, and his image is found in every Hindu temple, usually in the south-west wall of the building. Ganesa has only one tusk, because when Vyasa dictated the *Mahabharata* and desired someone to write it down for him, Ganesa volunteered to be scribe, and broke off one tusk for his pen, while for his paper he took the earth. Another version says that he lost his tusk in fighting his brother, Subrahmanyam, the god of war, who defeated him. At any rate, Ganesa is often known as "eka dantha," the one-tusked, on this account.

He is not yet married. His mother brought him several ladies to wife, but he refused them all, saying he would never marry till he found the girl who exactly resembled his mother. He is still looking for her, and his temple being usually at the entrance to every village, he can scan each fresh arrival as she comes forward.

Yali is a mythical animal, much stronger than a Lion, and the vehicle of Kali,* the goddess of destruction, who is not much worshipped in South India, because she requires libations of blood, which are distasteful to Brahmins.

Varaha, the Boar, is the third avatar of Vishnu. One account of this story has already been given, but another reason why Vishnu took this form was to punish two rakshasas named Hiranyaksha and Hiranykasipa, who were his enemies. The former rolled up this world into a mass and threw it into the sea. Thus was the earth lost for the time being. Vishnu, by taking the form of a Boar, dived into the waters, and bore it out again safely on his tusks, after which, in a fight, he slew the demon.

The Boar is not an animal adapted for an aquatic life, but in this case Hiranyaksha, by practising austerities, had obtained from Brahma the double boon of universal sovereignty and of immunity from injury by certain harmful animals, which were

* Parvati as Durga or Kali slew Mahisasur, the demon Buffalo, after which the state of Mysore is named.

enumerated, but unfortunately the Boar was not included in the list.

Narasimha, the fourth avatar of Vishnu, was half man and half lion. On the death of Hiranyaksha, the second demon said that he was the god, and made his subjects worship him and not Vishnu. Notwithstanding his father's commands, the son Prachlada believed in Vishnu, and thus incurred his father's enmity. One day Hiranykasipa challenged his son to prove that Vishnu was the god, and the son replied that Vishnu was everywhere. Then the father in derision asked if he were inside a particular stone pillar near by. On the son saying "Yes," the father got very angry with him, and out of contempt kicked the pillar, from which Vishnu as Narasimha at once burst forth and tore the impious wretch in pieces.

In his early days Hiranykasipa had done penance, and the boon granted him then was that he would not be killed by anything dead or alive, inside or outside his house, by day or by night, by man or by beast, and if a single drop of his blood was spilled, a thousand men as strong as himself would immediately spring forth to his assistance. He was slain by the claws of Vishnu as Narasimha, half man, half lion, on the doorstep of his house at sunset, and Narasimha drank up every drop of blood so that nought was shed. Thus were all the conditions of the boon evaded. To this day, in every Hindu house at sunset, all are asked to be quiet, for at this time Hiranykasipa died, and it is the hour for evening worship.

The common Shrew (*Crocidura cœrulea*), known to the Anglo-Indian as the "musk rat," is the vehicle of Ganesa. Its voice is held to be very auspicious, and it is never killed because it is considered so very harmless.

The Bandicoot Rat is the largest one. "As stout as a Bandicoot" is a familar comparison in South India. The Squirrels took part, along with the Monkeys under Hanuman, in the building of the bridge over to Ceylon. The little Palm-Squirrel (*Funambulus*) is one of the commonest animals. It could not do much to help, but it gathered a little sand on its bushy tail and threw it into the sea. Rama, noticing this act, was very pleased, and in blessing the tiny creature, stroked it with three of his fingers; hence the origin of the three lines down its back to-day. "And

the people tell how the little Squirrels helped in the building of the bridge to Lanka, bringing stones and shells and broken nuts to make it smooth. And for this, when the work was done Rama took one of the smallest workmen in his hand, and stroked him, blessing him from head to tail. And because of this blessing of Rama, it is that the Indian Squirrel wears three white stripes on his dark fur; they are the finger-marks of the blessing of the Lord of the Universe."

All Monkeys are sacred because of the monkey-god Hanuman. A maid called Angavadevi was one day doing penance and wishing for a son, when Vayu, the god of wind, visited her and granted her request, Hanuman being born to her. He is the type of strength and energy. Just after he was born he thought the sun was a fruit. It was the day of an eclipse, and the sun was just about to be swallowed by Rahu and Ketu, when Hanuman interfered. Rahu complained to Indra that he was being interrupted in his work by Hanuman. Indra then came with his club in his hand, and struck Hanuman a blow on the cheek, leaving a permanent depression there, which gave him his name, for Hanuman signifies having had something done to the cheek. Vayu, when he saw his son lying senseless, concentrated himself, so that all the atmosphere was withdrawn from the world, to the great dismay and annoyance of all the earth-dwellers, who complained to the great Hindu trinity, imploring them to restore matters. The gods all granted boons to Hanuman when Vayu had dissipated himself once more. Vayu made his son as swift as himself, Agni promised he would never be burnt or destroyed by fire, while Rama said he would withhold his arrow from him.

Wherever and whenever the *Ramayana* is read, there and then Hanuman is the unseen listener present to enjoy the tale. Hanuman is the favourite god of all the Raos and of conjurers. If his worship is not strictly attended to, then swift punishment falls on the offender.

NOTES ON THE INABILITY OF NATURAL SELECTION TO EXPLAIN CERTAIN STEPS IN THE EVOLUTION OF PROTOZOA.

By R. D. Greenaway.

During the past sixteen years biological study has made very great strides in all directions. Especially is this true in the departments of Heredity and Biogeny. The work of Mendel and De Vries and the teachings of Bergson have revolutionised these branches of biology. Constructive work has gone hand in hand with rigorous criticism of previous theories. Many of the most cherished conceptions of biologists have gone into the Medea's Cauldron of criticism, and not a few have shared the fate of Pelias.

The doctrine of natural selection has not escaped its share of criticism. The conviction, deepening every year, that evolution *has* occurred, has been attended by a growth of scepticism as to whether the theory which up to the end of the nineteenth century was held to have solved the riddle of organic existence really does so. This scepticism is no new thing; witness the objection, still with us (though robbed of much of its force by recent discovery), that incipient stages in the development of really useful structures would be too insignificant to secure survival. But of late three more fundamental difficulties have presented themselves. Firstly, the uselessness of many specific characters; secondly, the discovery of the fact that germinal variations (the only hereditary ones), are not the same as the minute fluctuations in every direction which were formerly believed to be of hereditary value. Finally, it is argued that, since true germinal variation is definite and comparatively infrequent, the development of highly complex organs (like the vertebrate eye) through the selection of random variations (difficult enough to conceive even if given a multiplicity of such variations in every direction) now becomes unthinkable.

It is real difficulties like these which are leading biologists to believe that the part played by natural selection in evolution has been in the past much over-rated; that it acts rather as the pruner of the Tree of Life than as its energy of growth; and that the final cause of evolution lies deeper, in the very nature of life itself; an idea as old as philosophy, and which has been given its latest and most splendid expression in Bergson's doctrine of the *élan vital*, the eternal self-evolving impetus which is Life and Mind.

The present article is an attempt to illustrate, by example taken from the lowest phylum of animals, another difficulty which is, I believe, more novel. This difficulty is, in brief, that while there are many structures whose development is theoretically explainable (frequently easily so) by the theory of natural selection, yet from the nature of present circumstances they cannot have been developed by selection. This idea originally suggested itself to me while engaged in the study of the Protozoa, and I have subsequently spent some time in its elaboration. The main conclusions which I have reached are outlined in the following pages.

1. Protective Coverings of the Thecolobosa.

The *Thecolobosa* are well known as amœbæ which surround themselves with a protective case. Most are not of large size, and there are not many genera; the best known are *Difflugia* and *Arcella*, the former being commonest of all in this part of the country (East Cornwall). The exact nature of the case with which they surround themselves is not entirely clear; it appears, however, to be chiefly chitinous, never calcareous or siliceous as in Reticularia. It also appears that in one genus at least (*Difflugia*) the outer surface of the case remains sticky and moist, and thus collects sand-particles and all kinds of *débris*, which cause it to much resemble that of a caddis-worm.

It might be thought at first that here is an excellent instance of selection; the case clearly acts as a protection against enemies, and by the contained organism's sealing up its mouth by a temporary operculum, affords a safe asylum in time of drought. This is perfectly true. But the difficulty is that while the

hypothesis that the case has been developed by natural selection is in itself quite workable, it does not fit in with the fact that the *Thecolobosa* are found to be living side by side with, under similar conditions to, their unprotected brethren. As I have myself observed, the bionomics of a *Difflugia* or an *Arcella* differ in no wise from those of any species of naked amœba; both classes feed on vegetable *débris* and minute Protophyta such as *chroococcacea* and diatoms; the reactions to external stimuli are similar; it is true that the shelled forms are very sluggish, but this is only to be expected. Now since the conditions of life are so similar, if the shell (which, it should be remembered, is simply a permanent exaggeration of the stiff protective cuticle that any amœba can form around itself in an unfavourable environment) has been formed by the selection of variations (no matter how caused), we should expect to find that the naked forms were either extinct or, at any rate, rare; since a shell, if necessary to a *Difflugia* for the prevention of its extinction, is equally necessary to any other kind of amœba. Instead, we find that the shelled forms are actually in a minority both in number of species, and in number of individuals.

It may, of course, be suggested that they are immigrants from the sea, where in company with the naked forms it is possible that they have been supplanted by the Reticularia; but it is impossible to understand how such a creature as a calcareous Foraminifer is any better placed than a chitinous-shelled amœba. In fact, the chief reason for the use of chalk as a building material seems to be environmental, due to the quantity of calcium compounds in sea water, and is not a point with special survival-value at all. The whole question, therefore, is, to say the least, extremely difficult of solution by any hypothesis based on the assumption of the action of natural selection.

2. Locomotion in Flagellata.

While many Flagellata possess only one flagellum, this number is as frequently exceeded. Thus in the group *Heteromastigoda* (which includes the well-known genera *Bodo* and *Volvox*, amongst others), the number of flagella varies from one to three. Again, some *Euglenoidea* have one long flagellum used for locomotion, and another (the paraflagellum), usually shorter,

trailed behind during progression, and serving apparently as an assistant in the process of feeding; I have also seen it used, in one species, as an anchor, a sticky secretion being apparently produced which fastens its tip to any solid object handy. Finally, the groups *Tetramitina*, *Polymastigina*, and *Trepomonadina*, which lead up to the peritrichous Ciliata, have from three to eight flagella, terminal and lateral, while the remarkable connecting form *Lophomonas* (which we shall meet again later on) has a bunch of about two dozen at its anterior pole.

Here, again, selection has some material to work upon. It cannot be denied that two flagella are better than one when, as often occurs, they give their possessor the power of more rapid and powerful movement, and so enable it to more quickly remove itself from danger; the value of such powers to a small organism is quickly realised by anyone who watches a *Paramecium* feeding. Again, two flagella may make a better vortex than one, and are hence more efficient for the collection of food.

Nevertheless, the theory which bases the multiplication of the flagella on the action of natural selection breaks down on closer scrutiny. If natural selection has been the cause of the development of poly-flagellate forms, then either the mono-flagellates must be adapted to different conditions of life than those of the former group, or else the latter less efficient forms must have become extinct or nearly so. Neither statement fits the facts. The conditions of life are precisely similar in both (highly-aberrant forms like *Euglena* excepted). In both cases the food-supply consists of bacteria and particles of dead organic matter; both types are found in every conceivable environment, from a horse-pond to a rain-barrel; there is no difference whatever. As to the second eventuality, no disproof of its non-fulfilment is needed.

Indeed, it does not seem that even the premises of the argument for selection are valid. It is true that the general preponderance of activity is on the side of the poly-flagellates and that many mono-flagellates are very large compared to others of the former group (not that their size is sufficient to be of much survival-value in competition with the much larger ciliates or with the *Heliozoa* or *Tentaculifera*). But many small mono-flagellates are as active as their relatives with more flagella than one; while others of

the latter class, such as *Astasia*, are more sluggish than others of equal size with only one flagellum (*e. g. Peranema*). Nor does the possession of the extra flagellum in the forms in which it is used for trophic purposes seem to have given these forms any advantage in the struggle for existence over their less well-furnished relatives, judging the case by the only admissible standard, that of preferential survival. Indeed, it is difficult to see how it could, since at present the food-supply is quite plentiful enough for all, and there is no reason to believe that it has been otherwise since very ancient times; bacteria and decaying vegetable matter were probably abundant in the Palæozoic seas. In this case too, therefore, we seem to be driven to admit that natural selection is not competent to explain the facts.

3. Evolution of the Ciliata.

The history of this step in evolution, like that of the one just discussed, is one of the further perfecting of what may be termed the "tropho-motor system"; that is, of the system of cell-organs concerned with feeding and movement. The general lines of development seem fairly clear. The ancestor of the Ciliates must have been Flagellates related to the existing *Tetramitina*. It probably possessed several flagella placed anteriorly, and was somewhat pear-shaped. The flagella seem to have multiplied by antimeric fission in such a way as to become arranged more or less around the mouth; at the same time they probably became shorter and stiffer, since a number of long flexible flagella would become entangled and neutralise each other's efforts. It then must have much resembled the existing *Lophomonas*, a linking form for whose preservation biologists have to thank that somewhat objectionable insect, the cock-roach, of which it is a parasite. Further progress consisted in the increased shortening of the flagella to the condition of short rods, and the reduction of their "musculature" to a contractile strip on one side, which, in conjunction with an elastic strip on the other side, caused a rhythmic sweep instead of the sinuous flexion of a flagellum. The organism was now a Ciliate, and must have borne a close resemblance to the very primitive peritrichous form *Strombidium*.

Such probably was the process. In favour of the view that selection was here the guiding force, it may be argued that all the connecting links have disappeared, save one which has been driven (presumably) to parasitism. This is true; but we are faced with the same overwhelming difficulty as before. The Ciliata are descended from flagellates, and have acquired in the process a tropho-motor apparatus vastly superior to that of their ancestors. They live side by side with flagellates, under precisely similar conditions, with precisely similar reactions to the ordinary stimuli of the environment; their food is similar; practically the sole bionomic difference is that the larger ciliates can ingest much more at once (which would indeed make for an even more speedy extinction of the much smaller flagellates). Everything seems to point to the conclusion that the higher types should have supplanted the lower simply in virtue of increased size and activity, and yet nothing of the kind has occurred. If development had in this instance been due to the selection of the in every way more "fit" ciliates, the flagellates as a class should be extinct, or at most confined to a few struggling groups; instead they are ubiquitous and racially vigorous. These facts, surely, absolutely preclude the ascription of the developmental process in this case to natural selection.

4. Size in Ciliata.

This is, as is well known, very variable in the different forms. For example, a species of *Halteria* is about 1–1000th in. long; at the other end of the scale are forms like *Trachelius* easily visible to the unassisted eye. The two very common genera, *Paramecium* and *Stylonychia*, both reach a maximum size of about 1–70th in. The widely-diffused *Coleps* is 1–500th in. in length; *Spirostomum* is said to be sometimes as much as 1–10th of an inch. (Personally, I have never found quite such large specimens.) Speaking generally, the peritrichous forms do not contain individuals of very large size, 1–200th in. being a fair average; *Stentor*, however, forms a notable exception. The other groups give us a mixed multitude of all sizes; the maximum is reached in the *Heterotricha* (*Kondylostoma*, *Bursaria*, *Spirostomum*) and the *Holotricha* (*Trachelius*, *Amphileptus*).

There can be no doubt that large size is a feature with survival-value, provided it is not carried to excess. In a single cell possibilities are of course limited by the necessity of keeping the ratio of surface to volume sufficient to allow of free diffusion of oxygen in, and carbon-dioxide and other excretions out; the development of the system of the contractile vacuole to the extent it attains in some large forms (*e. g. Amphileptus*) is possibly concerned with this necessity. But even so, a large range of variation is possible. The advantage of large size in a Protozoon is obvious to the practical biologist; *Coleps* is swept away by a current which *Paramecium* breasts without difficulty, *Euplotes* is captured by the Heliozoon from which *Bursaria* escapes. But, more independent and "fit" though the large forms are, they have not attained their high estate by the gradual extinction of smaller types. Both are equally vigorous. Indeed, it is the same throughout the whole phylum; the extremely minute and the relatively gigantic, *Bodo* and *Trachelius*, rub shoulders, so to speak, in every environment. Natural selection fails here, as before, in the explanation of the facts of biology.

5. Springing Organs of Halteria.

This genus, the typical one of the family *Halteridæ*, is distinguished by the possession, in addition to its ciliary ring, of an array of stiff spines, varying in number in different species. These spines are prolongations of the cuticle, and are movable on their bases by contraction of the myophane layer immediately underneath the cuticle. By sudden movement of the spines the organism can leap a good distance.

The value of such an apparatus, in facilitating escape from enemies, is obvious. Its sensitivity is very high; a mere touch of the tripod of the microscope, a current hardly visible, the touch of a spine on a bit of *débris*, is sufficient to cause a violent leap. But such structures as leaping spines would, if necessary for the survival of one form, be equally necessary for that of others of the same size and habits. If natural selection has acted here, should we not find in *Coleps*, *Urocentrum*, *Enchelys*, and the like, either similar structures or else others fulfilling similar ends? Should we not expect that all these forms, which

need protection from enemies in just the same measure as *Halteria*, should otherwise have become extinct, or nearly so? But that this has not occurred our microscopes tell us. How then can selection have played any part in the evolution of *Halteria's* spines?

6. Trophic Cilia of Bursaria.

This genus is characterised, among other points, by the possession in the vestibule of a series of short, very stout cilia arranged in regular rows, which work to and fro in unison and act as a very efficient trophic apparatus.

Now in essence these trophic cilia are simply an instance of the extreme development of the larger oral cilia found in all *Heterotricha*. In this genus they have reached a very high stage of development, forming an extremely efficient apparatus. The differences between the two kinds are, indeed, not overwhelmingly great, yet the trophic cilia of *Bursaria* have all the appearance of being due to real adaptive modification. But there can be no question that natural selection has played no part in their development, since the other species of similar habits are without them.

7. Setose Processes in Euplotes and Related Genera.

These are well marked, stiff, limb-like processes of a different nature to the trophic cilia of *Bursaria*. They serve as locomotor organs, and have a powerful system of muscular fibrils developed around their roots. By the energetic contractions of these the organism is propelled with a running motion with great velocity.

Considered as locomotor organs, they are far more efficient than the ciliary ring or coat. Indeed, in the most highly-developed forms like *Euplotes* the cilia have vanished, superseded by the styles and setæ. A progressive differentiation, too, can be detected in the *Hypotricha*, from forms without setæ to forms in which they are the only tropho-motor organs. We appear, therefore, to have here again an instance of progression towards greater efficiency, and this entirely independent of natural selection, since there is no sign of extinction of the less

well-provided types, whether among the other *Hypotricha* or in any other group.

Examples might be multiplied almost indefinitely, did space permit. But perhaps sufficient has been said to form an outline of the question under discussion—an outline admittedly sketchy and suffering from over-compression. The gaps necessarily left in the arguments and examples many readers will be able to fill in for themselves.

Although this paper is of intention critical, yet it would be hardly fair not to give some idea of what forces may have been at work to produce the results described.

A factor which suggests itself at once is that of the inheritance of characters acquired by use. Thus the development of spines in *Halteria* might be explained as due to the exercise of rudimentary spines producing their greater development in the individual, and as a result a modification of the germ-plasm in the same direction. But since experiment has shown, I believe conclusively, that somatic modifications are not transmissible even in unicellular forms, this hypothesis breaks down; though Lloyd Morgan's theory, that acquired characters may favour the propagation of mutations in the same direction, is important in this connection.

Probably the best explanation is to be found in some form of the orthogenesis theory, of continual progress in a straight line. A germinal mutation caused by change in the environment (in the broad sense of the term) produces change in the cytoplasm, and this change forms a kind of groove along which more mutations in the same direction accumulate.

To many a physico-chemical statement of such a process would be all-sufficient; but to others, myself among the number, such a statement seems only to give us an idea of the steps of the process, not one of the process as a whole. The problem of organic evolution lies deeper still. How can a mechanical statement of the orthogenesis theory explain, say, the marvellous correlation of variation manifested in the evolution of the vertebrate eye? As I say, the riddle's solution lies deeper. Each step in variation is physico-chemical, but variation itself is essentially the expression of the free creativeness of Life, of that "new form of energy" which inhabits protoplasm.

NOTES AND QUERIES.

MAMMALIA.

Grey Squirrel in Northamptonshire.—I have seen a Grey Squirrel which was shot about December 30th, 1915, at Weston, near Towcester, Northamptonshire. This is sixteen miles N.W. of Whaddon, where I saw one the previous May; and as it is less than five miles from the Oxfordshire border, I suppose we shall get this undesirable in the county before long.—O. V. Aplin (Bloxham, Oxon).

Do Rats Eat the Eggs of Poultry?—It is a very common belief that Rats will remove the eggs from the nests of Poultry and eat them, and one can get plenty of book and verbal evidence of the ways and means by which the eggs are removed, and that egg-sucking by Rats is very frequent. And yet in no single instance have I been able to obtain information that is satisfactory and not hearsay, and I have often questioned farmers and poultry-keepers on this point, but in vain; and I have never known an instance in years of personal experience in keeping poultry. That the habits of these vermin may vary in different localities is quite possible, and I should be glad of any satisfactory proof upon this question. That Rats do destroy Chickens and Ducklings, etc., I am only too well aware.—J. Steele Elliott.

AVES.

Reported Nesting of the Gannet in Orkney.—In the 'Zoologist' for last year (p. 433) I published the report of a pair of Gannets nesting on the Horse of Copinsay in 1911 (not 1914 as printed). I am now sorry to say that further inquiries have thrown some doubt on the statement, which seemed reliable at the time. I am informed that in an Orkney newspaper in that year the fact was noticed that one pair had nested for the first time. But another resident, living on that side of Orkney, who has been in the habit of visiting the birdcliffs of Copinsay for many years, in answer to my inquiries writes as follows: "No Solans ever laid on the Horse of Copinsay, but half a mile away is the island of Copinsay, with about three-quarters of a mile of cliffs, averaging 200 ft. in height, where tens of thousands of birds (*i. e.* other rock-birds) lay. Some fifty years ago

it was believed that Solans hatched there, but no correct evidence could be gathered now as the men are dead who lived there then." About 1907 or 1908 a pair of Solans lived about the cliffs for a short time during the nesting season, and a fisherman (passing there) told my correspondent he believed they were building. But nothing came of it, as no egg or young was seen. In fact, the birds disappeared before they had time to bring out a young one. My original informant is only able to repeat that it was stated at the time that one pair were nesting in 1911, though he does not seem clear as to whether it was on Copinsay or the Horse of Copinsay. He adds that it would have been very unlikely if the pair had got off its egg, as Copinsay is the only place in Orkney where the eggs of sea-birds are taken in large quantities. Here I must leave it; but it seems probable that about that year, at all events, a pair of Gannets contemplated nesting there, if they did not actually do so.—O. V. Aplin.

Snowy Owl in Bucks.—Intending to give the bird three or four weeks' law before making its presence known, I have inadvertently neglected to publish the occurrence for as many years. As, however, a visit from the species is rare throughout England, and unique so far as this county (Bucks) is concerned, a record of the fact is better late than never. On the afternoon of July 31st, 1912, while excavating a large and prolific Romano-British "Villa" on Yewden Manor in this parish (Hambleden), on Lord Hambleden's Greenlands estate, upwards of 400 yards north of Hambleden lock on the Thames, I overheard one of the labourers calling his mate's attention to a large white Owl sitting in one of a row of sycamore trees in the hedge dividing the field we were working in from the road running northwards. Hardly had he spoken, before, with characteristic plunge, followed by throw-up into the air, a Snowy Owl flew out, and came in our direction. As it approached it began to croak hoarsely (well described by Dresser, 'Manual of Pal. Birds,' as "a loud *krau-krau*"), and presently wavering in its choice of direction, it "trod air," and then turned round; but shortly deciding on its old course, it once more turned round, and again proceeded westwards, passing me at a distance I estimated at less than 80 yards. It continued to fly straight in that direction until I lost sight of it over and behind a group of large trees surrounding a pond known as "The Baths," which I believe to be of Roman origin or development, a quarter of a mile from the spot where I was standing. It was also seen by my overseer, Dr.

A. E. Peake, M.B.; by some eleven labourers; and by, I think, a few visitors who happened to be at the excavations at the moment. On August 2nd it was seen near Pheasants' Hill, also in Hambleden parish, but on the opposite (*i. e.* N.E.) side of the village, by a son of Mr. Louis Deane, who, unfortunately, was soon afterwards taken with a serious illness, which eventually terminated fatally, without my obtaining further details. Two or three days later Mr. Deane himself saw the bird in the same direction, and "was within eight or ten yards of it, and it flew broadside of" him. I am absolutely sure of the bird's identity, and it is a species for which nothing else is likely to be mistaken. Independently of the undoubted size, the croaking at once puts the Barn-Owl out of court, which seems the only bird which could under any possible circumstances be taken for it. Especially having regard to the time of year, it seems very much more likely that the bird was an escape from an aviary than a visitor under more natural conditions, but I failed to hear of any such loss; neither, so far as I am aware, was the bird reported from any other parish either before or after its sojourn in this one. A Snowy Owl seen flying at a little distance generally appears very white, so that although this bird looked white enough for an adult male, I cannot speak with certainty on this point.—Alfred Heneage Cocks (Poynetts, Skirmett, near Henley-on-Thames).

Early Autumnal Movements of Sandpipers, Ring-Plover, etc., in Bedfordshire.—Whilst walking around the Bedford Sewage Farm at Newnham, on July 15th last, the following species were observed: four Common Sandpiper, two Green Sandpiper, one adult and one young Ring-Plover, a "wisp" of six Snipe, and three Redshank, the latter being probably local breeding birds that nest in this locality. The occurrences of the three first-named birds are the earliest autumnal records I have of these species for that county.

The Common Sandpiper (*Totanus hypoleucus*) break their migratory journeys in the spring and autumn quite commonly, appearing generally at the latter end of April and early May; but I have records as early as April 7th, 1894, Cardington, and April 13th, 1903, Biggleswade, and as late as June 6th, 1903, Great Barford, June 8th, 1896, Turvey; their return migration taking place generally during August or early September, early records other than the present year being July 16th, 1905, Bletsoe, and July 24th, 1908, Cardington; and as late as September 13th, 1853, Biggleswade, and September 15th, 1902, Newnham.

The Green Sandpiper (*Totanus ochropus*) is very frequently observed during the autumn migration at the end of July and August, and on such favourite feeding haunts as at Newnham many may often be seen in company together; there does not seem to be a similar return journey in the spring when the Green Sandpiper can be looked for with any certainty, but at all other times it might be described as an erratic migrant, and, although not breeding in the British Islands, it has been met with in this county, as the following notes show, practically in every month of the year.

January.—31, 1855, Broom.

February.—No actual records can be given, but without a doubt this blank could be easily filled.

March.—10, 1905, three, Newnham; 29, 1897, Biggleswade.

April.—7, 1913, Willington.

May.—Once observed at Biggleswade by the late Mr. J. King, but no actual date was given to me by him.

June.—Mr. A. Covington, the local taxidermist, assures me it has once been obtained during this month.

July.—15, 1916, two; 27, 1901, one; 31, 1900, eight, all at Newnham.

August.—Solitary records during this month are far too numerous to narrate; 1, 1903, five; 9, 1899, fifteen, Newnham; 30, 1900, five at Moat Close, Elstow; 31, 1900, eight, Newnham.

September.—4, 1902, Newnham; 8, 1904, Goldington; 11, 1857, Biggleswade; 13, 1914, Blunham; 22, 1912, two, Newnham.

October.—16, 1904, Fenlake; 19, 1914, Millbrook.

November.—14, 1915, Cardington; 15, 1894, Pertenhall; 20, 1914, Renhold; 29, 1913, Ampthill.

December.—1, 1854, Broom; 19, 1860, Biggleswade; 23, 1900, Renhold; 26, 1894, Fenlake.

Ring-Plover (*Ægialitis hiaticula*).—Until a year or so longer when the old-fashioned methods of sewage disposal cease and the partly flooded arable fields still remain at Newnham, the Ring-Plover will no doubt continue to be observed regularly in that locality during the spring and autumn movements, and not infrequently at other times of the year also. In any other part of the county it has always been of rare occurrence, although I have known, from hearing their frequent calling overhead at night, that considerable numbers must on migration pass over this county. The largest parties of which I have notes are as follows:—In the autumn of 1878, seven were taken to the local taxidermist in one week; May 26th, 1898, six were seen together; August 18th, 1902, a flock of about twelve; April 27th, 1905, four; March 26th, 1916, a flock of nine in company

with a similar number of Dunlin. All these records are from Newnham. The majority of these notes are personal observations and from intermittent visits to that county; they must not be taken for careful and continued records. The results of such would be invaluable, especially from Newnham, for any future reference to migration in relation to Bedfordshire.—J. Steele Elliott.

Behaviour of two Young Cuckoos in one Nest.—On May 24th last I found the nest of a Meadow-Pipit on Baildon Moor, with three eggs and one Cuckoo's egg; near the same place last year a naturalist friend of mine found a similar nest containing one Cuckoo's egg, and on May 30th I found another Titlark's nest containing four eggs, one of which was a Cuckoo's. This was built in a pasture adjoining the moor, and separated by a distance of perhaps a quarter of a mile. The Cuckoos' eggs were evidently laid by different females, as the eggs were quite different in size, shape, and, in a lesser degree, coloration. On June 2nd a naturalist friend of mine from Bournemouth visited both the above nests in the morning, and in each nest the Cuckoo's egg had hatched, but the three eggs in each Pipit's nest were still unhatched. After inspecting the nests my friend and I had a long walk, and on returning in the afternoon, I found that one of the eggs in the nest on the moor had hatched, but the other eggs in the nest in the pasture were still unhatched. It was quite evident that the Cuckoos in the above nests were hatched within at most an hour or two of each other, and could not have been many hours old when we visited the nests on June 2nd. My friend and I again visited the nests on June 3rd, at about 9.30 a.m., and found that the nest on the moor contained one young Pipit and Cuckoo, and one egg of Pipit was thrown out and was on the rim of the nest, so another egg had been thrown out, or a young Pipit; but I could find no trace of either near the nest. Probably the young Pipit which was hatched on June 2nd had been thrown out by the Cuckoo. The nest in the pasture contained the young Cuckoo and two eggs of the Pipit, and another egg was lying on the rim of the nest, having evidently been thrown out by the Cuckoo. We had not long to wait before the Cuckoo began to be very restless, and in a short time it heaved the egg of the Pipit to the top of the nest by pushing the egg up the side of it, not balancing the egg in the hollow of its back as it sometimes does, soon after which operation it hoisted a young Pipit out of the nest. Afterwards my friend and I decided to place all the unhatched eggs in the nest on the moor, and place the two young Cuckoos in the nest built in the pasture; by this arrangement

we thought we should save a few Pipits' lives; but alas for human interference in matters of this nature! After carrying out this arrangement I accompanied my friend part of the way to his lodgings, which were at Baildon, and returned to the nests; in that which contained the young Cuckoos, one had been thrown out by the other, and in trying to get back into the nest it had got its leg fast in some mat-grass, but its head was hanging down into the nest. After extrication from the grass it fell forward into the nest again. At this point I left for some refreshment at a farm near by, and on my return both Cuckoos were still in the nest; the weather being very cold at the time, and I find young Cuckoos when associated with other nestlings are much more restless in warm than cold weather. However, fortunately, again I had not long to wait before Greek was pitted against Greek, and one would hoist the other to the top of the nest, but when the feat was within an ace of accomplishment, be defeated by the other grasping the top of the nest with both feet, the result being that both birds toppled again to the bottom of the nest. This process of hoisting each other from the nest continued until I left in the afternoon. Before leaving the moor I visited the nest of the Pipit to which my friend and I had committed the charge of eggs and young in the morning, but, strange to say, the Pipit was sitting on an empty nest, and the young Pipits were lying dead outside the nest; the eggs I could not find anywhere. Thus my confidence that the Pipits would hatch and rear the introduced eggs and young of its own species was sadly misplaced. I again visited the nest containing the young Cuckoos on June 4th and got there at 10.30 a.m., to find both Cuckoos outside the nest struggling together, their legs and wings being interlocked octopus-like. The weather at this time was very cold and even wretched for the time of year, and I quickly put both Cuckoos back into the nest, and had an hour's walk on the moor, the weather in the meantime getting worse, rain having set in, so I returned to the nest and found that one of the Cuckoos had again been thrown out of the nest, and owing to the cold weather was in a very torpid condition.

If the weather had been warm like the corresponding period last year, by frequently putting back the Cuckoo again into the nest when thrown out, I had hoped after about the fourth day that both Cuckoos would settle down and live afterwards contentedly; but in the circumstances I decided to leave one only in the nest and try to keep the other alive two or three days, and introduce it again into the nest, if successful in keeping it alive for this period, and in this I expected little difficulty, since I had reared the Cuckoo formerly without any difficulty what-

ever; but in the present case my hope was doomed to disappointment, for the bird died on the morning of June 6th, from lack, not so much, I believe, of suitable food, as of the proper amount of heat. It was only about two days old when it was brought home.

Adjoining Baildon Moor is a wood which is a famous rendezvous for Cuckoos, and although I found about eight nests of Titlarks with four eggs in each nest within a short distance from those containing Cuckoo's eggs alluded to above, yet in no other nest was there to be found a Cuckoo's egg, which is somewhat remarkable if Cuckoos lay as many eggs as is sometimes alleged. I may add that all the Titlarks' eggs contained in the above nests were laid subsequently to those I found in the nests of Titlarks on May 24th and 30th, and these could not all be unsuitable hosts for Cuckoos' eggs; and if Cuckoos do not abstract one egg from the nests of the dupes at or about the time of the introduction of their eggs, how have we to account for three eggs only in the nests of those I found, and four eggs in all the other nests not containing Cuckoo's eggs?—E. P. Butterfield (Wilsden, Bradford).

CHÆTOPODA.

A Note on the Behaviour of Nereis fucata.—On p. 238 of the present volume of the 'Zoologist' I described the escape of a *Nereis fucata* (which was about 3 in. in length) from the jaws of two Hermit-Crabs, and mentioned that the worm retreated beneath the pebbles on the floor of the aquarium. A few days after this incident the Hermit-Crabs were removed from the tank. The tank remained empty for nearly three weeks, and during this time I did not see the worm, which I supposed to be dead. Several newly-captured Hermit-Crabs and a commensal Sea-Anemone (*Sagartia parasitica*) were now placed in the aquarium, and soon afterwards (within a quarter of an hour) the *Nereis* made its appearance from beneath the pebbles. It moved rapidly to and fro upon the floor of the aquarium, and then, forcing its way under the whelk-shell of one of the Hermit-Crabs, tried to enter the shell beneath the body of the crustacean. The Hermit-Crab jerked its body in and out of the shell in such a way as either to prevent or deter the worm from gaining an entry, and then scuttled away, leaving the worm on the floor. The *Nereis* now re-entered the pebbles, and I saw nothing of it for two days. On the third morning I removed a half-digested mass which was encumbering the disc of the Sea-Anemone (the diameter of whose circle of extended tentacles was about 1½ in.), and discovered that this mass

was the remains of the *Nereis*. These facts seem worthy of record because the meaning of the association between the worm and the Hermit-Crab is only partly understood; indeed, the whole subject of the association of *Eupagurus bernhardus*, *Sagartia parasitica*, and *Nereis fucata* stands in need of fresh and intensive study.—H. N. MILLIGAN.

ASTEROIDEA.

Rate of Locomotion in Sun-Stars.—The usual rate of locomotion of the common Sun-Star (*Solaster papposus*) is not high. In a note published in the 'Zoologist' of 1915 (pp. 437-438), it was remarked that the average in a Sun-Star of 2 inches in diameter was 1 inch in 26·1 seconds; and subsequent observations have shown this to be approximately the rate of locomotion of other examples of about the same size. When occasion arises, however, a Sun-Star can travel at a much greater speed. Several of the captive Sun-Stars observed by me have had a peculiar habit (most marked in animals new to the aquarium) of moving upon food (say a piece of fresh Sea-Urchin, Crab, Shrimp, or Fish) placed close to them, then partially assuming the usual feeding attitude, and finally quitting the food very suddenly and retreating at a speed which I have not seen them attain under any other circumstances. (I do not know the cause of this behaviour.) I determined to ascertain as exactly as possible the speed of a Sun-Star when thus retreating, and I was able to do this in the case of an individual of $2\frac{1}{2}$ inches in diameter. The Sun-Star (which had been in the aquarium for ten days) retreated from a piece of recently-killed Sea-Urchin, and three separate records were secured in its succeeding wild career in the tank. It travelled in a horizontal direction upon the rough vertical rockwork which forms the back of the tank for a distance of approximately 10 inches in 30 seconds; it moved across the fine gravel on the floor of the tank for 7 inches in 30 seconds, and it climbed up the glass front of the aquarium for $3\frac{3}{4}$ inches in 30 seconds. It will be noticed that the Sun-Star was a small one. Large examples, say of 6 or 8 inches in diameter, seem always to creep very slowly, at all events in an aquarium.—H. N. MILLIGAN.

NOTICES OF NEW BOOKS, ETC.

British Birds. Vol. III. By A. THORBURN, F.Z.S. London: Longmans, Green & Co. 1916. £1 11*s.* 6*d.* net. Set of 4 vols. £6 6*s.* net.

BEAUTIFUL as were the first two volumes of this delightful work, the present one far surpasses the two combined, and in it the pictures worthy to be framed may be numbered by the dozen. This is, of course, what might have been expected, for the *Anatidæ*, now dealt with, are those among our birds which are most adapted for pictorial treatment, not only by their beauty of form and colouring, but, as has been remarked by other reviewers, by their gregarious habits, which render group-pictures of them more natural than is the case with most other birds. In addition to this group Mr. Thorburn undertakes in this volume the Spoonbill, Ibis, Flamingo, Storks, Sand-Grouse, Pigeons, Game-birds, and Rails, finishes the Herons, and figures the great Bustard as a frontispiece, the letterpress dealing with it closing the volume. He is thus well off for picturesque subjects outside the *Anatidæ*, and generally rises to the occasion; his concluding plate of Herons is a gem, though that showing the Storks and Flamingo is not nearly so good, the former birds being too rounded and short, with the hind toes far too small, and the latter too hard in outline and lacking the slim grace and looseness of plumage so characteristic of the species. Among the Ducks, the plate of the Mergansers is easily the best, and the diving species generally are better than the rest; the Sheldrakes are disappointing, their poses not being very characteristic, while, though full justice is done to the exquisite plumage of the Common Teal and Garganey, the Blue-winged Teal and American Wigeon are less happily rendered as regards their equally delicate colouring. Among the Swans, sufficient stress is not laid on the difference in size between the Whooper and Bewick's, nor does the plate of those Geese distinguish enough between the flat snaky head of the Brent and the rounder one of the Bernicle. The letterpress calls for no especial criticism; but we note some regrettable misprints, "*Mareco*" and "*Mereca*" for *Mareca*, on pp. 38 and 39; "Bartlet" for Bartlett on the latter; and "*arbellus*" for *albellus*, twenty pages further on.

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THE ZOOLOGIST

No. 903.—September 15th, 1916.

THE MAMMALIAN FAUNA OF NORTH CARDIGANSHIRE, WITH NOTES ON CERTAIN PECULIARITIES AND RARE SPECIES.

By Frank S. Wright,
University College of Wales, Aberystwyth.

It is perhaps not altogether a matter for surprise that, in North Cardiganshire, which possesses an attractive and varied avian fauna, the local mammals should have been somewhat neglected. In fact no very serious attempt has been made to study them, and the only list* seems to be that of Dr. J. H. Salter, in the N.U.T. Souvenir (Aberystwyth, 1911). The present paper cannot claim to be exhaustive, owing to pressure of work and the difficulties of travel in this mountainous and sparsely-peopled area. These factors have caused my visits to the hills to be usually of short duration. It is very difficult to elicit any information from the rural population, and many of the promises of help made by friends have remained unfulfilled owing to the abnormal conditions of the past twenty months. Ornithologists of no mean order are met with in many parts of North Cardiganshire, but, apart from that of the gamekeepers, to whom they are mainly "vermin," the mammals, less obtrusive than the birds, attract very little attention—luckily, one is tempted to add.

Despite the drawbacks just mentioned, in view of several

* In his book 'The Vertebrate Fauna of North Wales,' Mr. H. E. Forrest gives a number of North Cardiganshire records.

The passes through the mountain barrier which isolates Cardiganshire are few in number, and are themselves situated at a great height. Eisteddfa-Gurig (1350 ft.), a short distance south of Plynlymon, is the most important of them.

This barrier would seem to have excluded some birds approaching it from the east, and possibly some of the smaller mammals also. On the other hand, it has offered an asylum for other birds which have deserted many of their former haunts in Britain, owing to the draining of the land.

It will be attempted to show that the High Plateau has not been without its effect on the mammalian fauna of North Cardiganshire, which has undoubtedly found in it a sanctuary.

The conclusions which I have deduced from the records appear to me to be fully supported by the facts as these stand at present. Some modifications may be necessary as new records occur, but I venture to believe that such will but tend to strengthen the views which I have set forth in this paper.

List of Species.

Noctule, or Great Bat (*Pterygistes noctula*, Leisler).—Occurs in the district (Salter). Two large Bats, which probably belonged to this species, were repeatedly seen in the summer of 1915, at Penparke, near Aberystwyth, by Mr. F. Hutchings.

Pipistrelle, or Common Bat (*Pterygistes pipistrellus*, Schreb.).—Fairly common in the district. It would appear to venture into the settlements but rarely, as I have observed it to do elsewhere. It is occasionally seen on the Marine Terrace at Aberystwyth, where one was killed in a house in 1915 (Mr. H. R. Williams).

Natterer's Bat (*Myotis nattereri*, Kuhl.).—"A colony of Natterer's Bat has been found frequenting the tower of Llangorwen Church"—near Aberystwyth (Salter).

Long-Eared Bat (*Plecotus auritus*, Linn.).—Not a great deal is known with regard to the distribution of this Bat, which seems, however, to be fairly common. Mr. A. E. Lloyd showed me a specimen which he found recently in his bedroom at Rhydypennau, near Llanfihangel geneu'r-glyn.

Hedgehog (*Erinaceus europæus*, Linn.).—Common almost everywhere in North Cardiganshire. It is not infrequently found

in the streets of Aberystwyth Town, where it is sometimes carried by Dogs. I have sometimes heard its loud and plaintive cry from a considerable distance, when it is terrified. Long before dark, individuals may be seen crossing the roads, and many of them are of large size. In the evening of November 16th, 1915, I caught a large Hedgehog in the roadway at Penparke as it was running nimbly along. The day was a cold one, and frequent and very heavy hail-showers were falling. This cold spell had commenced some days previously. Hibernation had probably commenced some time before this date, and this individual was perhaps aroused through some unusual event.

Mole (*Talpa europæa*, Linn.).—Exceedingly common everywhere, even at a considerable height. Yellow-white specimens, generally called albinos, are not infrequently taken.

Common Shrew (*Sorex araneus*, Linn.).—Common in the district (Salter and others).

Water-Shrew (*Neomys fodiens*, Pall.).—Occurs in the district. Mr. H. R. Dickinson has seen a specimen in a stream at Ponterwyd (on the High Plateau).

Wild Cat (*Felis sylvestris*, Schreb.).—Long extinct in the district. I can find no records of the dates when the last local specimens were killed. Feral Cats are not uncommon in the preserved areas. I am convinced that the rare sight of the Pine-Marten (see under "Pine-Marten" in list of species and notes) gives rise to some of the stories sometimes current in the district of the appearance of a "true Wild Cat." It is at all events significant that the bushiness of the tail is very frequently cited by the observers.

Fox (*Canis vulpes*, Linn.).—Common in North Cardiganshire, where, owing to the nature of the country, it is hunted with difficulty. Foxes are sometimes observed on the main roads near Aberystwyth. A fine male, from near Llanfarian, near Aberystwyth, measured over 47½ in. from the tip of the nose to the end of the tail, and turned the scale at eighteen pounds. The years 1914–15 saw much depredation by Foxes in the poultry-yards and sheep-folds in some parts of Cardiganshire. In fact, Foxes were so numerous and troublesome that the farmers were compelled to organise regular "shoots" in

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self-defence. Well-marked colour-differences occur among the Foxes in the district (see notes on the mammals).

Pine-Marten (*Mustela martes*, Linn.).—Excessively rare on the Coastal Plateau, but a few may survive on the High Plateau east of Tregaron. A young male was trapped near Crosswood early in the summer of 1915, and I examined it in a fresh state. Mr. Hutchings said that this specimen was the first local Marten to pass through his hands for quite thirty years. It is believed to have been seen occasionally in the district during recent years (see under notes on the mammals).

This specimen was acquired for the Zoological Collection of the University College of Wales, Aberystwyth.

Polecat (*Mustela putorius*, Linn.).—Still not uncommon in North Cardiganshire, and, although it is relentlessly persecuted, its numbers appear to be fairly well maintained. Polecats are most numerous about Crosswood and Tregaron, and a good number are killed at Borth. The bogs at Borth and Tregaron favour this species, and all gamekeepers and sportsmen who are familiar with it are in agreement as to its choice of damp, but not marshy, soil. It ranges from the valleys up to at least 1300 ft. above sea-level,* and, in fact, wherever Rabbits are found. Polecats are sometimes observed on the shores of the Teifi Lakes, some distance east of Ystrad Meurig, where there are also a few Rabbits (Messrs. G. Fellowes, D. Lloyd, W. Phillips, T. Hopkins, etc.). These lakes are situated on the High Plateau, and they are much frequented by anglers. Mr. T. Hopkins, for many years a keeper in the Crosswood district, has given me some interesting details relating to the Polecats in his neighbourhood. He states that they subsist very largely on Frogs, and that they seek and devour greedily ripe blackberries. They are also recorded (Mr. J. Pryce Howell) from Yspytty-Ystwyth (700 ft.), and a hill near this village known as Mynydd-Bach (over 1000 ft.). Males are more numerous than females among the caught specimens. Mr. Hutchings receives large numbers for preservation every year. Many of the individuals are extremely dark in colour, and some are almost black.

Polecat (*Mustela putorius*, Linn). Local Light-brown

* This statement holds good only for those places concerning which I have been able to get information. See also under Rabbit in list of species.

VARIETY.—During the last ten or twelve years a number of Polecats of a very light colour have been killed in North Cardiganshire. In all other respects they resemble the dark-coloured animal, but the largest specimen of the light variety that has been caught exceeds slightly in size even the large individuals of the common Polecat. The colour may be described roughly as: underfur light buff, the longer hairy coat being a reddish-brown. When seen in sunlight the latter shows a kind of faint purple "haze"; it is difficult to describe it otherwise. The facial markings are the same in the dark specimens in all the examples which I have examined, but this would appear to be not invariably the case, according to Mr. Forrest ('The Vertebrate Fauna of North Wales'). These light Polecats are killed from time to time. There are only some three records of them for the years 1914–15, but this may be due to the unsettled condition of the country rather than to greater scarcity. (See also under notes on the mammals.)

I give a list of some of the localities in which this light Polecat has been killed, Mr. Hutchings being my informant with regard to the earlier occurrences.

The first light Polecats were killed some years ago at Tregaron. The parents were a dark male and a light female, while the young (about four) all closely resembled the light-coloured mother. Another male (Tregaron). A very large male* (near Llanilar). A male (Crosswood). A male (Goginan). A male (near Ynyslas). Other specimens, of which the sex is not known, were caught near Llanbadarn-fawr (one), Penllwyn (one), and Bow Street (one). A young individual was killed on Borth Bog early in the summer of 1915. Another, belonging to the same litter, resembled the common dark Polecat in every respect.†

STOAT (*Putorius ermineus*, Linn).—Abundant in the uplands and lowlands of north Cardiganshire. It has been killed in the middle of the town of Aberystwyth (1912). Stoats may often be seen on the main and other roads of the district. During wet winters I have observed that they become very bold and fearless. At such times I have actually released young Rabbits from them,

* Now in the U.C.W. Zoological Collection.

† In the same Collection. See also notes on the local mammals, where this occurrence is discussed more fully.

the fierce little carnivore looking on resentfully meanwhile, not greatly perturbed by my presence. Ermines are not uncommonly taken in cold winters, but these generally retain a trace of the summer colour, whilst the rest of the body is a very pale sulphur-yellow—rarely pure white. During the present winter (1915–16) I have seen a number of really white Ermines, which were killed in North Cardiganshire. A very large specimen from Ynyslas, and probably a male, was of a uniform snow-white colour, save for the dark-tipped tail.

Weasel (*Putorius nivalis*, Linn.).—Numerous everywhere in the district, although seen less frequently than the Stoat, probably owing to its more diminutive size. Mr. Hutchings has seen two pure white Weasels in the district. These were a male and female, and they were killed near Talybont during a cold spell of rather greater severity than is usual in West Wales.

Badger (*Meles meles*, Linn.).—Fairly numerous in the district, although, owing to its nocturnal habit, not often seen. These animals are said to devour Hedgehogs greedily,* and to rob the nests of Wasps, probably to get at the grubs (Mr. T. Hopkins). Badgers attain a large size in North Cardiganshire and adjoining counties, and one specimen which I saw weighed no less than 26 lb. It was caught near Machynlleth, Montgomeryshire, and therefore just outside our area. The hams of this large individual were eaten by an Aberystwyth *gourmet!* Badgers were rather scarce in the district thirty years ago (Mr. F. Hutchings). In some parts of Montgomeryshire they are believed to attack the lambs, but here, again, we may suspect the astute Fox.

Otter (*Lutra lutra*, Linn.).—Still far from scarce, especially in the southern part of the district, and where the rivers and streams are not polluted by the washings from the lead-mines. Some of the specimens which I have examined showed splendid fur and condition. Otters were fairly numerous in the lower Leri until recently, but they have now deserted this place, which, owing to mine pollution, is destitute of fish.

Common Seal (*Phoca vitulina*, Linn).—Seals are sometimes seen on the coast of North Cardiganshire, and they are said to breed in the vicinity of Monk's Cave. This species is not infrequently observed from the Marine Terrace at Aberystwyth. I

* Mr. Forrest has already noted this fact.

have myself seen three from this place swimming close inshore. They occasionally ascend the Dovey Estuary for a distance of three miles (Captain Enoch Lewis). It is to the credit of the Cardiganshire people that this interesting animal is seldom molested.

Grey Seal (*Halichærus gryphus*, Fabr.).—This species is recorded by Dr. Salter as sometimes frequenting the locality noted for the Common Seal. I have not heard that it has been observed very recently.

Squirrel (*Sciurus vulgaris*, Linn.).—Frequents all the wooded areas in North Cardiganshire up to a fair height. It cannot be said to be common, and in some places its numbers are diminishing (Mr. T. Hopkins). Individuals showing conspicuous patches of white fur have been observed at Llanilar and Clarach (Mr. W. Phillips).

Dormouse (*Muscardinus avellanarius*, Linn.).—I do not know anything with regard to the distribution of this species, nor have I ever seen a local specimen. It is recorded by Dr. Salter, and Mr. Hutchings informs me that he receives locally-caught specimens at long intervals.

Black Rat (*Mus rattus*, Linn.).—Probably extinct here. It has not been recorded for many years.

Brown, or Common Rat (*Mus norvegicus*, Erx.).—Common everywhere.

Common, or House Mouse (*Mus musculus*, Linn.).—Ubiquitous.

Wood Mouse, or Long-Tailed Field Mouse (*Micromys sylvaticus*, Linn.).—This species is probably common, and it occurs throughout the district. Mr. C. L. Walton saw a specimen of the Yellow-necked variety known as *Mus flavicollis*, in the early part of the summer of 1913, at Rhydyfelin, near Aberystwyth.

Water Vole, or Water Rat (*Microtus amphibius*, Linn.).—Common near the streams, except at great elevations. Near Pendybont Bridge, Llanbadarn-fawr, I have watched some Water Voles which frequented a small pond on the banks of the Rheidol. The pond is quite near to a footpath, and the Voles were very fearless, approaching quite near a spectator, and did not show any great alarm when they were chased away.

Field-Vole, or Short-Tailed Field-Mouse (*Microtus agrestis*, Linn.).—Common. Mr. F. Hutchings recently presented an albino specimen to the U.C.W. Zoological Collection. It was caught near Crosswood some years ago.

Common Hare (*Lepus europæus*, Pallas).—Although generally distributed, the Hare can scarcely be described as common in North Cardiganshire. It occurs on Borth Bog, and it is present on the High Plateau at greater elevations than those recorded for the Rabbit (*q. v.*). Mr. R. H. Dickinson says that the upland Hares show more greyness of fur than do the valley specimens.

Rabbit (*Lepus cuniculus*, Linn.).—The distribution of the Rabbit in North Cardiganshire is curiously uneven. The absence of Rabbits in certain places at a high level is due to the peaty nature of the soil. It is more difficult to account for their avoidance of some lowland tracts which are apparently suited to their needs. In many parts of the district they are very abundant. Melanism and other colour-differences are frequently shown. A few Rabbits occur as high as the Teifi Lakes (about 1300 ft.), and at the Angler's Retreat (1285 ft.), but these are perhaps mere stragglers. Peat, rather than any inherent weakness, or inability to withstand the more severe conditions of life on the uplands, may be said to govern the distribution of the Rabbit in height, in this district at least.

Lesser Rorqual (*Balænoptera acutorostrata*, Lac.).—A fresh carcase of the Lesser Rorqual was washed ashore at the foot of the cliffs between Aberystwyth and Clarach in the winter of 1911. It was probably a male, and it measured 28 ft. "exclusive of the jaw and tail," while its estimated weight was approximately 6 tons (Mr. Mortimer).

Bottle-Nose Whale (*Hyperoodon rostratus*, Müller).—Stranded (? dead) at Clarach, about 1902, this Whale measured between 14 and 15 ft. The skull, which is unfortunately not complete, is now in the Zoological Collection of the U.C.W., Aberystwyth. I have not been able to discover any other information about the cetacean, but Mr. Jack Edwards, who furnished these details, also showed me a photograph of the specimen.

Porpoise (*Phocæna phocæna*, Linn.).—Common in Cardigan Bay during the summer.

Notes on the Mammals of North Cardiganshire.

The Polecat was formerly abundant in Britain, but now its range is very restricted, owing to factors which will be obvious. From time to time its reappearance in a district which it was supposed to have deserted is noted, but some of these records are, perhaps, not above suspicion. The Ferret, which is itself believed to be a Polecat, though possibly a foreign one, mates freely with its wild relative. The hybrids (Polecat-Ferrets, Fitchets, etc.) which result from the cross, often bear a close resemblance to the wild parent in size, colour, and robustness of constitution. Some of the doubtful records may refer to hybrids which have become feral.

Cardiganshire, and more particularly its northern portion, is one of the few places in our Islands where the Polecat still maintains itself in some numbers, owing to physical reasons previously stated. The Borth and Tregaron Bogs have played no small part in preserving this carnivore from extinction. These large marshy tracts are situated in the north and south of North Cardiganshire respectively. They include patches of fair extent of comparatively dry ground, and such situations suit the requirements of the Polecat admirably.

Almost without exception the whole of the very numerous Polecats which I have examined were killed between the edge of the High Plateau and the sea, as would be expected. Much of the area of North Cardiganshire is given up to game, and is strictly preserved. It is from such localities especially that most of the Polecats are obtained, the greater number of them being taken in traps. Whether the Polecat occurs in any numbers on the High Plateau is a matter of conjecture, and one concerning which I have not been able to elicit a great deal of information. In certain parts of it this animal is seen at least as high as 1300 ft. (see under Polecat in list of mammals), and the probability is that it populates the greater part of the edge of this region. Now the habitable and cultivable land in North Cardiganshire forms a relatively narrow strip between the High Plateau and the sea, and this fact may not be without significance. It must be remembered that the yearly toll of these creatures in the district is a heavy and constantly increasing one, especially

in view of their not excessive fecundity. Yet it is remarkable that, despite the persecution to which this carnivore is subjected, its numbers would appear to show no appreciable diminution* in recent years (Mr. F. Hutchings and others). The amount of woodland in North Cardiganshire is not great, and it seldom bears the undergrowth necessary to shelter animals. It seems but reasonable to infer that, in order to survive and maintain its numbers on the Coastal Plateau in North Cardiganshire, there must exist some kind of natural "reservoirs" whence the Polecat spreads. It has been shown that such exist, in some degree at least, in the Borth and Tregaron Bogs. The suggestion is now advanced that the edge of the High Plateau, and at least some portions of its interior, also foster this animal, and such few facts as I have been able to gather are confirmatory of this statement. The constant process of extinction that proceeds in the valleys and preserved areas is compensated by the influx of animals from the adjacent hills.

Not only does the common Polecat hold its own in the district, but it would even appear probable that, during the last ten or twelve years, a distinct colour-variety has arisen.† In Mr. Forrest's 'Vertebrate Fauna of North Wales,' two examples of the Polecat, obtained in North Cardiganshire in the years 1902–3, are recorded. Mr. Forrest notes their light reddish-brown colour, and comments upon the absence of the usual facial markings borne by the common type. In the 'Souvenir of the

* In certain districts at the foot of the hill-barrier. In other places it is now very seldom seen.

† It may be objected that the introduction of ferret blood among the wild Polecats has tended to produce this lightness of colour. Mr. T. Hopkins told me that he lost a Ferret for a considerable time, but subsequently trapped her with her three or four young, which were all of a light-brown colour. I do not know how closely these young animals resembled the light-coloured Polecat described by Mr. Forrest and in the present paper. In this instance the colour of the male parent is not known, and it must be remembered that several of the light Polecats were taken in this neighbourhood (Crosswood) Consequently this record is an isolated and unsatisfactory one. The red-brown animals are exceedingly uniform in colour, and their young (of the first generation—nothing is known concerning the second) breed quite true to type. "Polecat-Ferrets" show considerable diversity as to colour, but after much inquiry I am unable to mention a single case where these hybrids could be mistaken for the wild light variety of Polecats.

Aberystwyth Conference, 1911,' of the National Union of Teachers, there is a note on these interesting animals by Professor H. J. Fleure. He says: "The localities from which the specimens come preclude, one would think, the hypothesis of its being due to a single sport." He concludes that, "as all the animals in a litter belonged to it" (the light variety), it proved "the light colour to be an innate character of some stability."

Since Professor Fleure wrote the above note several fresh records have to be chronicled, and they lend additional support to his statement. In July, 1915, two young Polecats* from the same litter were killed on Borth Bog. This case is a very remarkable one, because, whereas one of the young animals resembled in every respect the common dark Polecat, the other† one just as closely resembled the red-brown variety of this district (see also list of species). It may be stated here that other specimens of the light type were available for comparison at the time. It is to be regretted that neither of the parents was seen, but it is noteworthy that in the two offspring the colours show no intermingling whatever.

Since 1903 several of these light-coloured animals have been taken, and nearly all of them were examined by the writer while they were fresh. They were all killed on the Coastal Plateau between the River Dovey and Tregaron. The majority of the specimens were obtained near these two places, which are situated in the north and south of the district respectively. The interval between them, some eighteen miles, is bridged by one or two records nearer Aberystwyth, which occupies a midway position on the coast.

The total number of the red-brown Polecats which have been recorded is between twelve and fifteen. We may add 50 per cent. for other animals of this colour which have been killed and not recorded, remembering that this percentage is a high one for North Cardiganshire, where the unusual is generally inquired into. It will be gathered that the variety exists in small numbers, or else is adept at concealment. The red-brown Polecat seems to be confined to the district, and has not been recorded elsewhere.

* Now in the U.C.W. Zoological Collection.

† This proves the red-brown colour to be a Mendelian character.

In all the examples of this beautiful animal which I have seen, and unlike those noted by Mr. Forrest, the facial markings were well shown, but owing to the lighter ground colour of the animal the contrast was naturally not so great as in the common dark Polecat. In the light type individuals of both sexes occur, but, as in the case of the common Polecat, the males preponderate slightly among the caught specimens. Mr. Hutchings believes that, in one or two individuals, the irides were of a light brown colour, but in the majority of cases they are dark like those of the normal type.

However this variety may have arisen, it is extremely improbable that it arose in more than one place, whence it has spread to the several localities mentioned in the list. The relative narrowness of the Coastal Plateau in North Cardiganshire has been emphasised already, and in view of what we know of the distribution of the light Polecat, it would seem to have originated somewhere between Crosswood and Tregaron. Now Borth is some miles north of these places, and it is unlikely that the animal reached this place by way of the lowlands. It is far more reasonable to suppose that it travelled thence along the edge of the High Plateau, where it would find sufficient food for its needs. In this manner it may have contrived to establish itself in fair numbers there, and thus the captured specimens may represent mere strays to the lowlands. More records are required before the last hypothesis can be regarded as proven.

While the lightness of colour may be an instance of semi-albinism, yet in an order some of the members of which exhibit such marked seasonal colour-changes, it may conceivably have arisen in the Polecat through a change of environment or food, or other cause, and due to an upland habit.

I have compared several skulls of the Ferret, Polecat, and red-brown Polecat, and, apart from the fact that the Ferret's skull appears to be somewhat less robust than the others, I can find no marked difference.

The Pine-Marten was believed to have long ceased to dwell in North Cardiganshire, until a specimen was trapped (see list of species) near Crosswood early in 1915. This record of an animal of excessive rarity is again within the neighbourhood of Crosswood, and near the foot of the High Plateau, and it cannot be a

mere coincidence. The Marten, although well distributed, was never common in Britain, and it is very scarce at the present time. It is sometimes recorded in localities where it has not been seen for a great number of years, and because of this fact some authorities are inclined to attribute to it a wandering habit. This inference is probably correct in many cases, but, although the Pine-Marten is still found in Merionethshire, there are certain facts which tend to show that the parents of the specimen herein recorded may have dwelt in the district. A keen naturalist of this district told me that he had seen, and shot at, a Pine-Marten, just north of Aberystwyth, some years ago. The animal made good its escape, and was not seen afterwards. Another, residing in Aberystwyth, saw an animal that answered to the description of a Pine-Marten, some few years ago, in some stunted trees near Monk's Cave. I am inclined to believe that this animal has managed to survive in North Cardiganshire, on the edge of the High Plateau, or near the Teifi Lakes, but in such small numbers that it is now very seldom seen. Mr. Forrest found that the Merionethshire Martens, discovering that even the large woods in that county failed to afford them adequate protection, have now taken to the stony heights. This shows a certain degree of adaptability to changing circumstances. The presence of numerous obstacles in extreme north Cardiganshire, and the almost total absence of timber there, would seem to preclude the possibility of this young (probably in its second year when killed) animal having wandered solitarily along the uplands from Merionethshire to nearly mid-Cardiganshire. It certainly did not come *viâ* the Coastal Plateau. Consequently, it would seem not unlikely that this species also has been preserved from utter extinction in the district through the agency of the High Plateau.

Some of the mammalian dwellers in the uplands are said to differ slightly from their valley congeners. Mr. Hutchings states definitely that he can distinguish a mountain Fox at sight, by its greyness and denseness of fur. I recently examined a Fox which had been killed near the summit of Plynlymon. Instead of the usual white markings on the belly and chest, in this specimen these portions were quite black. The rest of the body bore a thick admixture of black and white hairs, which imparted a

curious "grizzled" appearance to the animal. This animal's teeth showed it to be a fairly old individual. I have quoted elsewhere Mr. R. H. Dickinson's statement with regard to the greyness of the mountain Hares, all of which he believes to belong to the common species. These slight differences would appear to show that a moorland habit has not been without its effect upon certain mammalian types.

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NOTES ON THE FAUNA OF THE COUNTRY OF THE CHESS AND GADE.

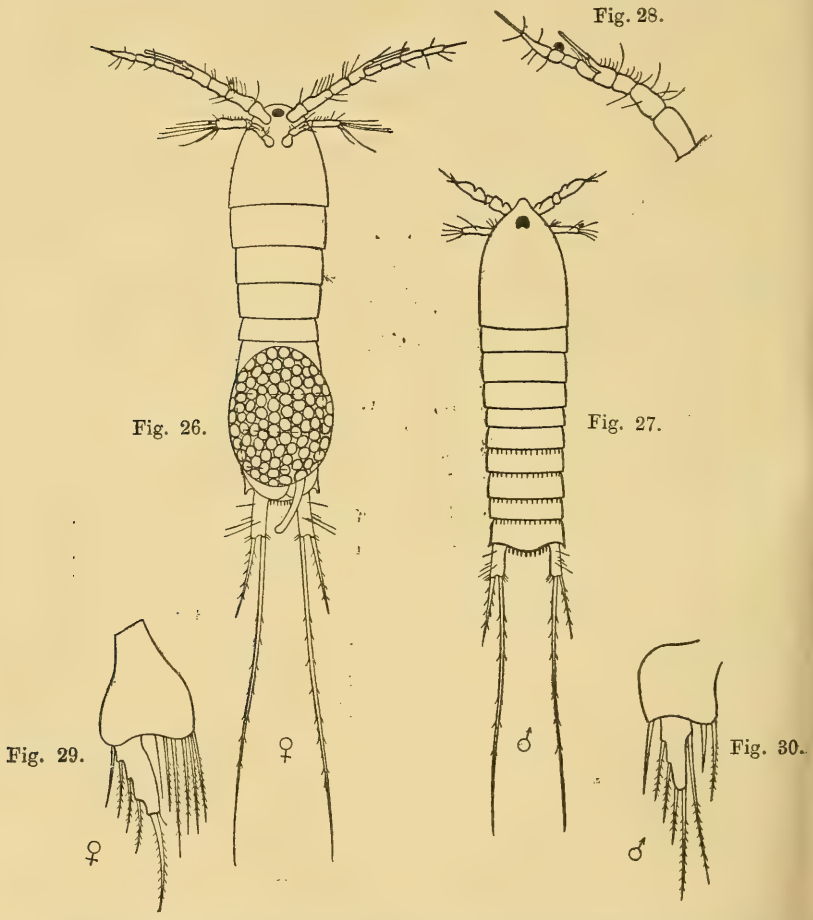
By T. E. Lones, M.A., LL.D., B.Sc.

(Continued from vol. xix, p. 425.)

The next species to be described belongs to the family of Entomostraca called *Harpactidæ*. In members of this family the body is cylindrical or flat, and there is no marked division between the cephalothorax and the abdomen, such as is seen, *e. g.*, in *Cyclops serrulatus*. The antennæ are short, and the swimming-feet, especially the third and fourth, are unusually long, even the fifth pair of feet being well developed. The structure of the fifth pair of feet in the male differs from that in the female, but in both sexes they are two-jointed, and the first or basal joint is usually broad and plate-like. Further, except in a few species, each female carries only one egg-sac.

2. *Canthocamptus staphylinus*, Jurine.—The chief features of this Copepod may be described in a few words. Its head is large and formed by the fusion of the cephalic and first thoracic somites. The second, third, and fourth segments are approximately equal in length. In the female the abdomen has four segments, the first being very large and formed by the fusion of the first and second abdominal somites. In the male the abdomen is composed of five segments. The posterior edges of the segments, in both sexes, are finely toothed.

The first antennæ of the female have eight joints, of which the fourth carries a long, stout seta. In the male there is a well-marked hinge-joint between the fifth and sixth segments of the antennæ, and the fourth segment carries a long, stout seta; the



cilia of the second, third, fourth, and fifth segments are numerous and crowded together. There are five stout setæ on the inner part of the basal joint of the fifth foot of the female, and two on that of the male. Other details of structure are shown in figs. 26 and 27, which respectively represent a female in ventral view and a male in dorsal view, in fig. 28, which shows one of the antennæ of the male, and in figs. 29 and 30, which show the

fifth foot in the female and the male respectively. All these figures were drawn from specimens taken from Langleybury Pool. In fig. 27 the anterior antennæ are shown as they appeared, bent and twisted upwards.

The flexibility of the long tail-setæ is very great. A specimen of *C. staphylinus* from Berkhamsted Castle Moat, obtained on September 30th, 1913, was examined when confined in a very small drop of water on the slide. During the vigorous struggles of the animal these setæ were repeatedly bent two-double without breaking. Finally they snapped, after a very great number of such bendings.

The females, especially those taken during the autumn and winter, are often found with a curved, reddish-brown spermatic tube attached to the first abdominal segment. It was from this occurrence that the generic name is said to have been given by Mr. J. O. Westwood, about the year 1835, such generic name being derived from *akantha kampte* (curved spine). He refers to his genus in 'The Entomologist's Text-book,' London, 1838, p. 115, and in Partington's 'British Encyclopædia of Natural History,' London, 1836, vol. ii, p. 228; in each of these works the genus is called "*Canthocampus*, having for its type *C. staphylinus*." The name *Canthocampus* seems, however, to be a misprint for *Canthocamptus*, and all other writers, whose works on the Copepoda I have consulted, spell the generic name *Canthocamptus*.

Another interesting feature of *C. staphylinus* is the extreme flexibility of its body between the fourth and fifth segments. When specimens are watched under a lens, or even by the naked eye, especially when they happen to be moving over the sides or bottom of the vessel containing them, they are seen to bend their bodies as they swim with a peculiar jerky motion through the water. Further, when they are dead, they are commonly seen with their abdomen bent at a sharp angle to the rest of the body. From this feature Jurine gave the specific name *staphylinus* to this Copepod, because its caudal parts were bent after the manner of the caudal parts of the *staphylinus* beetle.

By some authorities on the Copepoda the species under consideration has been called *Canthocamptus minutus*, Müller. Considering, however, the relative sizes of various species of

Canthocamptus, the name *minutus* is somewhat misleading, whereas *staphylinus* indicates very well the features of flexibility referred to above. Further, Müller's description and drawings of his *C. minutus* do not prove identity with the species considered in these notes, whereas the *staphylinus* of Jurine, who gives a much better description and set of drawings, seems to be the same species. All this, however, would be of little importance if the name *C. staphylinus* were not largely used by authorities on the Copepods; but the number of authorities who adopt the name *staphylinus* is probably as great as that of those who adopt the name *minutus*.

Canthocamptus staphylinus is the commonest Harpactid in the country of the Chess and Gade, and has been taken in very large numbers during the autumn, winter, and spring. By far the best locality known to me is Langleybury Pool, and other good localities are Berkhamsted Castle Moats, Cholesbury Common Pool, Parsonage Farm Pool, and several other weedy localities, *e.g.* the brooks near the Canal, the Chess, and the Gade. The notes on Langleybury Pool show that numerous specimens, many of these being females with ovisacs or spermatic tubes or both, have occurred during the last few years during the months November to April, both inclusive; that the number of specimens, and especially of ova-bearing females, was less in May; that June, July, August, and September gave poor results; and that the number of specimens increased rapidly in October and reached a maximum in November.

The prevailing colour of the females was light red, but some were grey or nearly colourless; the males were usually grey. On March 26th, 1914, the specimens were very numerous, and one was very conspicuous by reason of the brilliant whiteness of the underside of its body and its swimming-feet. This seems to have been an example of albinism. Among invertebrates albinism is by no means rare; *e.g.* I have found several pure white Earwigs and almost white specimens of *Asellus aquaticus*.

The colour of the egg-sacs of *C. staphylinus* was most usually a very dark green, brown, or blue; the colours were so dark that to the naked eye the egg-sacs seemed to be black. In a comparatively small number of specimens the egg-sacs were grey, bright green, light blue, light reddish-brown, or nearly

colourless, and in one specimen, obtained from Langleybury Pool on February 3rd, 1916, the ovisac was bright red.

The manner in which the number of specimens of *C. staphylinus* varies at different parts of the year is very striking. One series of records will illustrate this. Langleybury Pool did not yield a single specimen on August 20th, 1915, although the pool was almost entirely covered by a thin film of bright green duckweed. The pool was swarming with specimens of another Entomostracan, *Daphnia rotunda*, and there were but few Copepods. On September 6th, 1915, after a very careful examination of two water samples, two specimens of *C. staphylinus* were obtained, both males. Another collection taken on September 11th, 1915, yielded only three specimens. The next collection was made on November 20th, 1915, beneath a thin coating of ice. Hundreds of specimens were obtained, very many with spermatic tubes attached, and a rather large number with ovisacs; a small proportion of the specimens, about a tenth, were males. There must have been many millions of specimens of *C. staphylinus* in Langleybury Pool on that November day, but not one specimen of *D. rotunda* was obtained. On August 20th, 1915, as already stated, no specimens of *C. staphylinus* were obtained, so that between August 20th and November 20th vast numbers of *D. rotunda* disappeared and were replaced by vast numbers of *C. staphylinus*.

Numerous specimens of *C. staphylinus* have also been obtained from Berkhamsted Castle Moats, Cholesbury Common Pool, Parsonage Farm Pool, and from a small pool near Ashley Green, but the periods of the year when the largest collections have been made have not been the same as those given above for Langleybury Pool. In the year 1913, for instance, only two specimens were obtained from Langleybury Pool on June 18th, but a large number was collected from the moats on June 3rd, and while Langleybury Pool furnished many specimens on November 12th, only a few were obtained from the moats on November 21st. Again, in May, 1914, many specimens were obtained from Langleybury Pool, and only a few from the moats.

The pools of Chipperfield Common, Leverstock Green, Chesham Road, Frithesden, and Hastoe have furnished speci-

mens, but the results obtained have been insignificant compared with those obtained from Langleybury Pool. There is not much duckweed in the pools thus yielding comparatively few specimens, and duckweed is a very suitable aquatic plant for the rapid development of *C. staphylinus*.

3. *Cyclops viridis*, Jurine.—This is a very variable species, and the numerous differences which have presented themselves caused me much confusion, especially when examining specimens about fifteen years ago from the districts of Tring, Aylesbury, Cheddington, and Dunstable. At that time Mr. Brady's 'Monograph on the Copepoda' was my chief guide. Under the name *Cyclops gigas*, Claus, he gives a description which applies to the larger forms of *C. viridis*, Jurine. Following him, I used to consider *C. gigas* to be a distinct species, and this was consistent with the finding of numerous specimens, to which his description applied, in nearly every pool from which water samples were taken. There was no difficulty in identifying them; their large size, well-packed elongated and divergent egg-sacs, the forms of their antennæ and feet, and the relative lengths of the tail-setæ proved them to be specimens of *C. gigas*. Sometimes, however, large specimens and also smaller specimens were taken, all presenting the structural features of Brady's *C. gigas*. Whether small or large, all of them seemed to be fully developed, and many of the females carried egg-sacs. The small forms seemed to have no right to the title *gigas*, for, compared with the other forms or with many other Copepods, they certainly were not giants. The doubts caused by the finding of apparently adult specimens having the same characteristic features, but differing greatly in size, were to a large extent removed when, some years later, I was able to consult Mr. Brady's "Revision of the Freshwater Cyclopidæ and Calanidæ" in the 'Nat. Hist. Trans. of the Northumberland, Durham, and Newcastle Society,' vol. ii (1894), and also the writings of some other authorities. Of these, some consider that both the small and the large specimens are identical and do not even constitute varieties, whereas Herrick and Richard consider *C. gigas* to be a variety of *C. viridis*, Jurine. Also, on p. 82 of the paper referred to above, Mr. Brady says: "There is no sufficient reason for the separation of the two forms. *C. gigas* appears to be simply a very

large variety of *C. viridis*." Again, M. Jules Richard considers *C. gigas* to be merely a variety presenting no specific difference from the normal type.

The numerous specimens of *Cyclops*, having the specific features of *C. viridis*, obtained during the last four years in the country of the Chess and Gade will be described in the manner stated by Brady and Richard, the smaller forms being considered to be *C. viridis*, and the large ones to be a variety *gigas*.

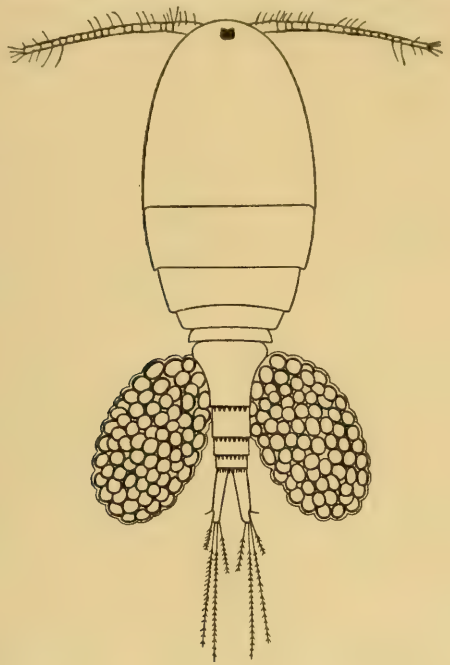


Fig. 31.

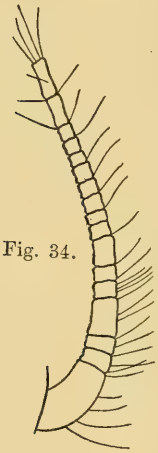
Fig. 31 represents a specimen of *C. viridis* of the normal type in dorsal view. The anterior antennæ are 17-jointed and nearly as long as the first cephalothoracic segment. In outline the cephalothorax approximates to an ellipse; in fact, an ellipse drawn with its major axis a little longer than twice its minor axis serves as an excellent guide in drawing the cephalothorax. The furcal segments are comparatively long, and each has a conspicuous lateral spine. All four tail-setæ are richly ciliated; the third is the longest, and the first or outermost the

shortest. The posterior edges of the first, second, and thir abdominal segments are notched or serrated, and the posterior edge of the last segment is ciliated. The ovisacs are divergent elongated, and well packed with eggs, forty or more being visible at one view.

Fig. 32 shows the form of the fifth pair of feet, drawn from a *gigas* specimen taken from Parsonage Farm Pool. The form of the fifth is practically identical in all specimens of the species and its variety *gigas*. The first joint of the foot is very short and broad, and its outer part carries a long, curved seta;

Fig. 33.

Fig. 34.



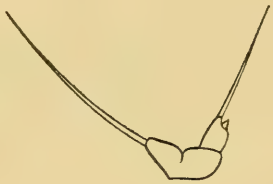


Fig. 32.

the second joint is small and carries a short spur, and a long, nearly straight seta.

Fig. 33 shows the form of the *receptaculum seminis*. The specimen from which it was drawn was from Langleybury Pool, and the drawing was made after the specimen had been narcotised. The *receptaculum*, especially its upper section, was somewhat contracted, but the figure shows its form very well.

Specimens of *C. viridis* have been obtained chiefly in the months of April, May, August, and November, and have been most numerous in the two months first mentioned. Chipperfield Common Pool and Langleybury Pool are very good localities for the normal form of the species. Special reference will be made

only to those collections for which my rough notes give information about variations in the specimens.

On April 8th, 1913, numerous specimens of *C. viridis* were taken from Chipperfield Common Pool. Many of them had ovisacs; they were very much the same in size, viz., about $\frac{1}{18}$ inch in total length. The antennæ varied in length, being a little shorter than the first segment in some, and as long as that segment in a few of the specimens. The lateral bristle of the furcal segments was situated decidedly farther forward than it is in the *gigas* forms, and in one specimen the innermost tail-setæ were not much longer than the outermost.

The length of the furcal segment in *C. viridis* is subject to great variation, but the greatest difference in this respect was noted among a few specimens taken from Langleybury Pool on November 20th, 1915. In some of these the length was more than three times that of the last abdominal segment.

The colours of specimens taken in the country of the Chess and Gade were dull green or brown, the ovisacs being usually dark green or brown, but occasionally light green or sandy.

Males have been found on many occasions, but they seem to be more numerous during the winter months. They were more slender and graceful than the females, with strongly hinged antennæ, and usually of a red colour. On January 27th, 1916, several water samples from Langleybury Pool yielded one male for every four females, and, on February 3rd, 1916, the water samples from the deeper parts of the same pool yielded comparatively few adult specimens of both sexes but several thousands of immature specimens, all of a red colour, in the Nauplius and Copepod stages.

Of *C. viridis*. var. *gigas*, I have very many records. In many cases they have been taken together with specimens of the normal type, but many of the rough notes record specimens of *gigas* without any reference to the normal type. Large numbers, with ovisacs, have occurred in the months of March, May, June, July, and October, while fewer specimens have been obtained in the other months of the year. The localities yielding specimens of *gigas* are also numerous, the chief being, roughly in descending order, Berkhamsted Castle Moats, Parsonage Farm Pool, Frithesden Pool, the Gade at several parts between Great Gaddesden and

Hemel Hemstead, Chipperfield Common Pool, Langleybury Pool, Chesham Road Pool, Ashley Green Pool, the Chess near Rickmansworth, Boxmoor Common Pool, and various brooks near the canal.

For identification purposes, one of the most important structural features of specimens of *Cyclops* is that of the fifth pair of feet. In most cases, the determination of their structure demands some care and patience, but in specimens of *gigas* this determination is unusually easy and can be made without the need of dissection. Fig. 32 was drawn from a narcotised specimen as it lay on its back under favourable illumination.

The largest specimen of which I have any reliable measurements was obtained from the small pool on Boxmoor Common, from which the rotifer *Hydatina senta* was obtained, as has been stated already. The specimen of *gigas* was one of a fairly large number, all females, dredged from the pool on October 16th, 1912. From the tip of its cephalo-thorax to the ends of its longest tail-setæ was 4·5 mm. or above $\frac{1}{6}$ in.

The greatest numbers of specimens obtained on one occasion were taken from the inner moat, Berkhamsted Castle, on June 3rd, 1913, and July 21st, 1913; from Frithesden Pool on October 3rd, 1913; from Parsonage Farm Pool on December 19th, 1912, March 24th, 1913, July 21st and July 27th, 1915; from Langleybury Pool on August 20th, 1915, and September 4th, 1915; from Boxmoor Pool on October 16th, 1912; and from a small pool near Ashley Green on July 21st, 1913. The rest of the collections made on many other occasions from these and other localities usually consisted of one, two, or not more than five specimens.

Ova-bearing females have been obtained in every month of the year, but they have been most plentiful in March and July. Males have been obtained in greatest numbers in February, March, July, and September; March seems to have given the best results.

The usual colour of the marginal parts of the cephalothorax (the central parts being brown or black from the presence of the alimentary canal) was green, brown, bluish, or dull grey. The ovisacs were usually green, brown, or grey of various shades, but most often dark; sandy ovisacs, also, have not been rare.

On September 12th, 1912, a white specimen with black alimentary tract was obtained from the brook near the Canal at Hunton Bridge, and on September 18th, 1912, a specimen with nearly white ova was taken from Parsonage Farm Pool. It may be mentioned that the colours of the ovisacs ought to be observed as soon as possible after specimens of Copepods have been taken and are in full vigour of life. In specimens which are dead or sickly the ova lose their distinctive colour and finally become bleached.

Besides the difference in size there is is not much to distinguish *gigas* specimens from those of the normal type. In *gigas* specimens from the country of the Chess and Gade, the basal parts of the anterior antennæ (see fig. 34) always seem to be relatively stronger and thicker than in specimens of the normal type, and the fifth pair of feet usually appear to be better developed. At any rate, their structure can be determined much more readily and easily. Variations in the relative lengths of the antennæ and furcal segments in both the normal and *gigas* forms are such as do not furnish any reliable distinguishing feature.

(To be continued.)

NOTES ON SOME IRISH BIRDS.

By the Rev. J. M. McWilliam.

Co. Monaghan, with which most of these notes deal, is most remarkable for such birds as the Great Crested Grebe, the Water-Rail, and the Grasshopper-Warbler, which breed in considerable numbers; indeed, I know no place where these birds breed more numerously. I have no specially rare birds to record, but I have a few minor additions to make to the breeding-list as given in 'The Birds of Ireland.'

The Common Tern is mentioned in the county list as possibly breeding in Co. Monaghan. It breeds regularly, and has done so for many years, on a small chain of lakes near the border of Co. Cavan, about thirty miles from the sea. Two or three pairs come every year, but they never increase in number.

The Black-headed Gull, too, has to be added to the breeding list for this county. A few pairs bred in 1903 in the same locality as the Common Terns, and apparently numbers of these birds breed regularly somewhere in the neighbourhood, as they are constantly to be seen there in the nesting-season.

The Shoveller is given in Mr. Ussher's list as possibly breeding in Co. Monaghan. In the last ten years it has bred regularly on these same lakes. I had seen these birds occasionally in previous years, but it was not till May, 1906, that I actually found the nest. I was rowing in to a point of land,

when a drake Shoveller rose close to the shore, and was joined at once by a female. After a short search I found a duck's nest with eleven buff-coloured eggs, still quite warm; but till then I had never seen a nest of this species, and I could not be certain of the identity of the eggs or down. I waited under cover, and in a quarter of an hour the Shovellers came round again, flying low over the nest, but before the duck could go to it they were disturbed by a passing boat. In the evening I went back to the nest. The duck rose from it, but it was too dark to identify it for certain, till when it had flown a few yards the drake Shoveller joined it, and both flew round again quite close to me.

Earlier in the day I had seen another Duck's nest, but had not examined it closely, and, on thinking over the whole incident, I fancied that the eggs in it had been rather too small to belong to a Mallard. I was not able to get back to these lakes for some time, but on going there three months later I found the nest again, though the eggs had hatched out, and was able to get enough of the down and feathers to identify it also as a Shoveller's. The drake Shovellers in this place had a curious habit of sitting out in the middle of the ploughed fields, where they were as conspicuous as they could be; I saw them doing this repeatedly. Since that year the Shoveller has bred here regularly, but I have never seen more than three pairs in a season.

The Grasshopper-Warbler is not given in Mr. Ussher's list as breeding in Co. Monaghan, but it is comparatively common. I have only found the nest once, and on that occasion the place where the bird was nesting was trampled over by cattle before the eggs were laid. I watched the bird here one morning while the nest was being built. It was sitting on a low bush of some kind, a couple of feet from the ground, trilling quietly at intervals. I have seen these birds quite near me several times, running almost like Mice through the rough cover. I have heard them in many places in Co. Monaghan, but I only found the nest this once.

The Whinchat is given in Mr. Ussher's list as possibly breeding in Co. Monaghan. I shot a young bird on August 29th, 1905. Last year I tried for some time to watch a bird to her nest, but in the end the bird's patience lasted longer than mine.

I have seen Whinchats in this county on two or three occasions in the nesting season, but they are not common, and I have never found the nest.

To the list for Co. Leitrim I have to add the Rock-Pipit. It breeds commonly, as might be expected, along the three miles of the Leitrim coast-line.

For Co. Sligo I have to record the Great Black-backed Gull and the Black Guillemot. I found a nest of the Great Black-backed Gull with two eggs on the mainland of this county on May 30th, 1906. Since then I have seen these birds in the same spot in other seasons, but have never seen another nest. Does this bird not breed regularly in Co. Sligo? It may be an accidental omission, but it is not given in 'The Birds of Ireland' as breeding there.

Two or three pairs of Black Guillemots nest in one very quiet locality in the east of Co. Sligo, and have done so, I have been told, for many years. They never increase in number. Eight years ago there were three pairs, and when I went back there last year I found just the same number. I have been told that Choughs bred in this spot many years ago.

Last year I spent some time at a large colony of Arctic and Common Terns in Co. Sligo. I was surprised to find that out of perhaps five hundred Arctic Terns' nests not one had more than two eggs. There was a much smaller colony of Common Terns breeding on one part of the ground occupied by the Arctic Terns, and the nests of most of the former had three eggs. I spent some hours with a glass, identifying the birds as they settled on their nests, but could not find a single Arctic Tern with three eggs; and on the parts of the shore occupied by the Arctic Terns alone there were certainly no nests with more than two, though the clutches had been completed for some days. I had been at that colony some years before, and a note in my diary says that "very few" Arctic Terns had three eggs then. I cannot even make a guess at the proportion that year, but I fancy that several of the nests had three eggs. Last year the Little Terns, too, in this colony had fewer nests than usual with three eggs.

The breeding status of certain of the Ducks is one of the most puzzling questions in Irish ornithology. Mr. Ussher's list

gives the Wigeon as possibly having bred, though without complete proof having been obtained in a single case, in four counties, the Pochard as possibly breeding in ten counties, and the Pintail as having probably bred in two counties. He appears to admit definitely one record made many years ago for the last species in Queen's County, but definite records of the breeding of all of these Ducks in Ireland are greatly to be desired. I can only add to the mystery by saying that I have seen a drake Pochard in Leitrim early in the nesting season, in a place where it may quite possibly have been breeding, and that I have seen Pintails in two different counties quite late in the breeding season. I saw drake Pintails twice in Co. Monaghan in June some years ago, and last year, on June 24th, I saw a drake Pintail on a lake in Co. Sligo. It was at a distance of about a hundred and fifty yards from me, and the day was not too bright, but I watched it carefully with a telescope for some minutes and could distinguish the white stripe through the brown on the neck. Some day all of these Ducks will be definitely proved to breed in Ireland.

I have two inland records for the Black-tailed Godwit in Ireland. When I was staying at Ballinamore in Co. Leitrim, on April 26th, 1906, a bird of this species was brought for sale by a small boy. It was priced at one shilling, as a Woodcock! It was brought with the inevitable lie that it had been caught in a rat-trap, but I heard later that it had been shot out of a large flock at Garadice Lake. It was alive, with one wing broken, and in splendid breeding plumage. The other record for Black-tailed Godwit is for Co. Monaghan. I was at a Duck "flight" with my brother in the first week of August, 1912, when we saw what we took to be four Curlew flying past at a considerable distance and whistled them in very successfully, and some very bad shooting added one Black-tailed Godwit to the bag. A few days later we saw two more in the same neighbourhood. It would seem that on migration these birds sometimes take an inland route. In 'The Birds of Ireland' it is stated that a very few have occurred in spring, chiefly inland, and that ten occurrences altogether have been recorded in inland counties.

NOTES AND QUERIES.

MAMMALIA.

Do Rats eat the Eggs of Poultry?—Referring to the query of Mr. Steele Elliott in the 'Zoologist' (*ante*, p. 312), I have kept poultry for some years in a wood through which runs a considerable stream, and have been at times much troubled by these rodents, and have even found them asleep in the nest-boxes; yet I have never actually witnessed this propensity on the part of Rats to which Mr. Elliott refers, although it is a popular belief with poultry-keepers that they do eat eggs. This much, however, may be said with confidence, that the habit, at least in some districts, is not general.—E. P. BUTTERFIELD (Wilsden, Yorks.).

Rats and Eggs.—The question raised by Mr. J. Steele Elliott concerning the removal of eggs by Rats recalls an incident of my boyhood. Our poultry-house was adjacent to a large barn. One year some Ducks nested in the poultry-house, and we soon had good reason to suspect that Rats were eating the eggs, by finding a "sucked" one at the mouth of a hole which apparently went through the wall and under the barn floor. My father, in the hope to obtain direct evidence that Rats had actually removed eggs from the poultry-house, had some of the barn flooring opposite to the hole taken up; at about three yards from the hole we found egg-shells and two or three intact eggs near a rats' nest. I showed Mr. Elliott's note to our museum attendant, who, as he had been at one time storekeeper in a grocery, is well acquainted with the ways of Rats. He is confident that Rats suck and also remove eggs, and mentioned several instances that had come under his notice. He says that he and his friends "use china nest-eggs because the Rats would carry away a real egg if it were left in the nest for a night." He has known Rats to burrow under nests and remove the eggs.—E. W. SWANTON (Educational Museum, Haslemere).

AVES.

Yellowhammers' Nest in Rick.—No ornithological work that I have consulted (including 'Yarrell,' fourth edition; Saunders, 'Manual,'

first edition; Dresser, 'Manual,' etc.) mentions the nesting of Yellowhammers in a rick; it is therefore probably worth putting on record that this unusual site was adopted in the rickyard here in July, 1916.

Someone, economically minded, has twisted a wisp of straw into a knot and pushed it into the side of a rick of oat-straw, forming a slight bulge that may be described architecturally as a bracket; the nest is countersunk in its surface, which is about 3 ft. 7 in. from the ground, on the south-west face, and begins about 2 ft. 3 in. behind the cut front of the rick. It is lined with beards of barley from a neighbouring rick, together with some long hairs from a Cow's tail. The eaves of the thatch are little more than a foot above the nest, and, numerous straws having slipped, form a fringe helping to screen it. The four eggs therein were safely hatched by July 29th; and the young birds flourished, but on the afternoon of August 8th the nest was empty, a Rat being the most likely culprit.

The unusual site seems to have been adopted in consequence of an inspiration approaching reason, because the hedge-banks are rat-haunted, so it was doubly unlucky that the catastrophe should nevertheless have been caused by one of these pariahs.—ALFRED H COCKS (Poynetts, Skirmett, near Henley-on-Thames).

Gannet's Method of Diving.—In Prof. Newton's article on Gannet, in the 'Dictionary of Birds,' he describes it as closing its wings and dashing perpendicularly into the water. I do not know if attention has ever been called to this statement. As a matter of fact, the Gannet dives with its wings open, and obviously its eyes also, till immediately before striking the water. Neither does it always dive perpendicularly. I have often seen it diving at an angle very distinctly removed from the perpendicular, and once or twice I have seen it fly almost to the surface of the water at quite an acute angle. During its descent to the water it frequently alters its direction, sometimes using two or three strokes of its wings for that purpose, so it clearly keeps its eyes on the fish till the very end.

In the same article Prof. Newton refers to the large proportion of immature Gannets which he observed near the Stack in June, 1890. Up t'll now, August 8th, the proportion of immature birds off Bute has been surprisingly small; I doubt if one bird in fifty has any trace of immature plumage.

It has often been remarked how unwilling the Gannet is to fly over the land. On this shore it often flies within five or ten yards of land, but I have never yet seen one which I thought was actually over the dividing line.—J. M. MCWILLIAM (Craigmore, Bute).

Nesting Notes from Sussex.—Linnet (*Linota cannabina*). *May* 23rd: I found a Linnet's nest built in a gorse bush about 3 ft. from the ground. It was made of dry grass lined with sheep's wool and a little hair, and contained three eggs. 24th: Another egg laid. At the time of finding this nest I was not certain of its identity, so I took one of these eggs. 27th: A fifth egg laid. Hen now sitting on four eggs. 28th and 31st: I visited the nest on both these dates and found the eggs safe. The nest is well hidden, but there is a great danger of its being robbed, as there are so many about here who are only too ready to rob and destroy nests. My fears were realised to a certain extent on visiting the nest on *June* 2nd, when I found the nest deserted though the eggs were in it. The latter were quite cold. Whilst walking near the site of this nest on the 23rd I crept into the gorse to look at the nest, when, to my surprise, I noticed another nest at the same height from the ground in a similar position, only a little further into the gorse patch. It contained two eggs, and they felt cold to my touch, so I took one of them. Not altogether satisfied with my conclusions, I looked at the nest the following day (the 24th) and noticed that another egg had been laid. I was unable to visit the nest again until the 27th, when it contained five. 28th: Five eggs safe. *July* 1st: Eggs safe and hen sitting close. 5th: The eggs were not hatched when I visited the nest this evening. 9th: Three out of the five eggs hatched. The next evening (the 10th) the fourth egg was hatched, but the fifth showed no signs of life. 12th: The four youngsters are doing well. 23rd: When I went to look at the nest this evening, there were three fully fledged young in the nest and one egg. They were strong on the wing, and flew off into the thicker parts of the gorse when I approached within a yard of them. 28th: The remaining egg cold and the nest deserted.

Blackbird (*Turdus merula*). *May* 26th: In a low bush, almost on the ground, by the side of a ditch, near Westdean, I found a Blackbird's nest containing four eggs. I knew of several Blackbirds' and Thrushes' nests near this one which had been pulled down as soon as the young appeared, and so I was fearful lest this one should share a like fate; but, contrary to my expectations, on going to the nest on the 27th, I found the four eggs safe. 30th: Two of the eggs were hatched when I looked at the nest this evening, the young birds opening their beaks when I parted the leaves above their nest. The third egg was just hatching. The shell was off the right side, and the youngster was making convulsive movements with its only free limb, namely, the right leg. It beat the air with this leg and then drew it back into the shell close to its body; this it did at short

intervals whilst I was watching the nest. The fourth egg was cracked, but showed no signs of movement inside. 31st: All four eggs hatched. *June* 2nd: Nest and young safe. The latter are covered with a blue-grey down. 7th: Young growing. The dark-brown feathers of adolescence are beginning to make themselves noticeable, especially on the back. Between this date and the 14th I was prevented by duties from visiting the nest, but on the latter date the youngsters had gone.

Goldfinch (*Carduelis elegans*). *May* 26th: Situated a little over 3 ft. from the ground, in a bush at the top of a high bank, I found a Goldfinch's nest. It was beautifully made of wool and hair throughout, and held five eggs. There was no bird sitting on the nest when I found it, but on the following evening (the 27th) I approached the nest as quietly as the surrounding vegetation would permit, and saw the hen bird sitting. She seemed very tame, and let me come quite close, though eyeing me all the time with a certain amount of suspicion. 28th: Eggs safe. 30th: Two of the eggs hatched; the others show no signs of hatching just at present. The two young that are hatched are covered with long, white, hair-like down. *June* 7th and 8th: Visited the nest on both these dates. The young birds are growing fast, though they are still covered with the long white down. The skin has a bluish appearance. 14th: 5 p.m., one bird only in the nest. 6.30 p.m., found the rest of the family in a tree about 200 yards away from the nest.

Skylark (*Alauda arvensis*). *June* 27th: Whilst walking along the Eastbourne road this evening, on my way back from making an observation of the Linnet's nest above mentioned, I was startled by a Lark flying up from the grass at the side of the road. After a little searching I found the nest with four eggs, and, judging from the weight, I thought they would not be long before they hatched. I was rather doubtful whether the Lark would succeed in hatching the eggs, as the nest was so near to the road. On the 28th the eggs were safe, and by the 30th all four were hatched. *July* 1st: Young birds safe. 5th: Two of the birds have disappeared. I do not think they have left, as, when I looked at the nest next time (the 9th), the other two young, though quite strong, had not done so. They stumbled out of the nest into the long grass when I uncovered the nest. I should have liked to have watched the nest closely to see exactly what day the birds did leave the nest altogether, but was unable to do so until the 12th. On this date the nest was empty, so I hunted round the nest, but could find no trace of the young.

Reed Warbler (*Acrocephalus streperus*). *June* 7th: A nest I

found in the reeds some few days ago was completed when I visited it this evening, and contained one egg. It was very conspicuous, as it hung in the reeds where they were rather thin, so I did my best to cover it up with some of the reeds that had been broken down near it. 8th: Another egg laid. 11th: Nest empty. I did not visit it again till the 25th, when I found three eggs laid and quite warm. 26th and 28th: Eggs safe on both these dates. *July* 1st: Nest badly tilted on one side, but the eggs are still safe; it is impossible to right the nest. 9th: One well-developed young bird the sole occupant of the nest. 12th: Assuming its adult feathers. 15th: Youngster flown.—HERBERT E. J. BIGGS.

House-Martins' Nests usurped by Common Sparrow.—I used to pass a public-house near here (Wilsden) frequently last year, which had many House-Martins' nests built on its south side. First one and then another was usurped by the Common Sparrow until near the end of summer every nest of the Martin was appropriated for nesting purposes by the Sparrows, and this is by no means a solitary instance in this district. The Sparrows are driving the Martins away from the haunts of men to their more natural habitat.—E. P. BUTTERFIELD (Wilsden).

Swallow Building in Chimney.—Whilst visiting a friend recently I came across the autobiography of Thomas Cooper, author of the 'Purgatory of Suicides,' in which he speaks in an early chapter of visiting an uncle who resided at Market Rasen, and with what delight he used to watch the Swallows come to their nest, which was built in a wide chimney, whilst he sat in one of his uncle's rooms. It would be interesting to know whether this habit used to be general or merely local, for I cannot find any authority for the statement from the oldest men I have ever questioned in this district with reference to this matter (and their experience would carry them to about the first decade of the 19th century, about the period to which Cooper refers in the above work) that the Swallow ever chooses for a nesting site a chimney. It nearly always builds its nest on a rafter or beam in a barn or outhouse in this neighbourhood, and rarely builds its nest on the Continental plan, without some support for the base of nest, like the House-Martin.*—E. P. BUTTERFIELD (Wilsden).

* Both the former building of the Swallow in chimneys and the frequent usurpation of Martins' nests by Sparrows are familiar habits, but it is not surprising if they are not noticed and recorded everywhere; we saw this year Martins safely rearing young in an isolated nest at Brockley, S.E. London, in spite of the presence of Sparrows. A good deal no doubt depends upon the accessibility of other nesting sites. Sparrows, too, we have noticed in observing albinistic specimens, are very local in their attachments, and no doubt different local "strains" vary in aggressiveness. See also Mr. Cocks's note.—ED.

House-Martins and House-Sparrows.—A dozen years ago I made some alterations to this house, and some half dozen years later various eligible sites for building purposes which it offered attracted the attention of two or three adventurous pairs of House-Martins. Their experiment proving a complete success, their numbers have increased each subsequent season, doubtless by the addition of the previous year's young birds to the old stock.

The north side of the house is the favourite, but the eastern one runs it close; the south side is less run after, while not a single nest has been built on the western side. Architectural considerations have considerable influence on this selection, but not an exclusive one. All the nests on the north side (fifteen at the moment of writing) are crowded into a somewhat short stretch of wall where the eaves overhang in a most comfortable manner, between two shallow wings or projections, on which no nest has ever been attempted. On the whole western side the eaves hardly perhaps hang over far enough to afford complete protection. On the other hand, there have been several nests on the east and south sides built on portions of wall that have no overhanging eaves to speak of, and also a few built in an upper corner of the recesses of windows. I am not aware of any recent observations on this point, but in 'Homes Without Hands' (1865, p. 317) the late Rev. J. G. Wood has some very relevant remarks, too long to quote in full, and I must only extract the following: "The points of the compass are always noted by the Martin, for there are some points which it clearly detests. . . . A wall with a north-eastern aspect is a favourite locality, while a southern wall is seldom chosen. . . . My own house, however, forms an exception, . . . for the Martins have chosen to build on the south wall only, probably because the eaves project so far that after 9 a.m. the nests are in shadow. Moreover, . . . a narrow ledge . . . forms a support for the nests."

The Martins start nesting immediately on arrival at their summer domicile; this year my first intimation of their return, at about 10 a.m. on April 23rd, was the cheerful chatter of one of these wholly delightful little birds, and I looked up in time to see it pay a visit of inspection to its old nest, which it must have flown straight to on completion of its migration. The latest young do not leave the nests until September (I found a hatched-out egg-shell freshly dropped on August 24th this year).

Perhaps once in a season a nest falls, but it would seem as if every nest were carefully inspected before being entrusted with another clutch of eggs, or rather with a second brood of young, whose weight

steadily increases and whose movements daily become more vigorous; if the nest is not considered safe, I feel sure the old birds entirely demolish it, and scatter the *débris* in very small fragments at a distance, so that one does not find them; and this they do even when they build the new nest on a fresh site. At any rate, nests disappear, leaving marks on the walls so that their former existence is indisputable, but no remains are visible on the ground, as is the case when a nest falls. Mr. Wood (*loc. cit.*) says that "the material of which the nests are built is a kind of mud, which becomes tolerably hard when dry, and is strong enough to exist for a series of years, and to serve for the bringing up of many successive broods." I believe, however that this lasting property depends on two factors: the consistency of the mud when used owing to the amount of the recent rainfall, and also on the geological or chemical composition of the material; anything of a stiff clayey nature would surely last much longer than anything of a light sandy nature.

That House-Sparrows are apt to appropriate the nests of House-Martins is very well known, but it is perhaps not so well known that the builders and rightful owners may kill the young of the invaders. I think there can be no doubt this vengeance was inflicted here this season. My eye was caught one day by a fully-fledged young Sparrow lying dead on the ground under the thickest group of the Martins' nests; and I saw that the entrance to one nest had been enlarged, the lining of poultry feathers protruding; so going up by ladder I found that the nest contained a single young Sparrow, dead like the one on the ground; but, while the latter was quite fresh, the one in the nest was rather stale; and I therefrom infer that the Martins had not time to kill both the young birds before the old Sparrows returned, but had to wait to complete their full resolve until they found the coast again clear, two or three days later. Perhaps the second victim had tried to escape, and was only given the *coup de grâce* after it was actually outside the nest. I regret not having skinned the heads of these birds to look for peck-scars, but it must take a good many blows from so soft and feeble a weapon as a House-Martin's beak to kill a tough, nearly fully-grown young Sparrow. The nests are certainly inaccessible to Rats and Cats, or even, I am sure, to Squirrels; besides which, any of these animals would have pulled the nest down. No other cause of death that seems in the least probable has occurred to me.—ALFRED H. COCKS (Poynetts, Skirmett, near Henley-on-Thames).

White Wagtail Nesting in Yorkshire.—There is little doubt that this year the White Wagtail has nested at Scarborough, thereby

verifying the remark of the author of the 'Birds of Yorkshire' (vol. i, p. 124): "There seems no reason why some of the White Wagtails which are noticed every year on migration should not remain to breed." A friend sent me some photographs of two young Wagtails just ready to fly, asking my opinion on them. The nest was in the cliffs at the north end of the town, and the finder, who saw the parent birds, was quite sure they were not Grey Wagtails; my friend was equally sure they were not Pied. He knows the birds of his district pretty well, and not long ago obtained a very good photograph of the Grey Wagtail on her nest, clearly showing the long tail of this species. I may add that he is one of the most tender-handed and tender-hearted of men, and no living creature utilised as a model for his numerous life-studies is ever in any way the worse for it.—JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds, Suffolk).

Zoned Type of Cuckoo's Egg.—Since recording the "zoned" Cuckoo's egg (p. 273) three more of the same type have been found in Reed-Warbler's nests, two by myself and the third by a young friend. They are all exactly alike, and whether any more were laid no one can say, as it is impossible to search all the reed-beds in the "Low Meadows." No doubt some hen Cuckoos are more prolific than others, as is the case with Owls; the Tawny Owl is sometimes content with two eggs, but a clutch of five is not unknown.—JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds).

Long-eared Owl as a Pet.—Hearing a few weeks ago that a schoolboy neighbour had a pet Owl, I went to see it, quite expecting to see a young Tawny Owl, and hoping that it was not one of those which came off from our nest-box. But, to my surprise, when I was introduced to it, it looked up at me with the splendid orange-yellow eyes of a Long-eared Owl. It became very tame, and when let out would fly round and come on its owner's shoulder for food. The cry was very much like the mewing of a Cat asking to be let in. Its evening flights became more and more prolonged as the summer advanced, till at last it took one from which it never returned, much to my own regret, as well as to its possessor's. A more beautiful and interesting pet I have seldom seen, and I much wish that some bird-photographer had been here to secure a few pictures before it took its departure.—JULIAN G. TUCK.

PISCES.

A Note on the Vibratile Fin of the Rockling.—Whilst examining several fishes which had arrived from the seaside in a collecting-can

on April 1st, I noticed a good instance of the utility of the vibratile fin of the Five-bearded Rockling (*Motella mustela*) in keeping clear the dorsal groove. The fishes had been in the collecting-can for a day or two, and the water was so dense with rust that the fishes could not be seen until they were lifted out. The slimy body of the Rockling, which was about 6 in. in length, was completely covered with a thick coat of rusty particles, the vibratile fin and the groove excepted, and the latter stood out conspicuously as a smooth dark area from the red rust. Rocklings coated with sand, but with a clear groove are of course sometimes to be found; but that the fin should act so efficiently during a long and exhausting journey in a collecting-can of rusty water seems noteworthy. I may add that vibration of the fin could be started by a touch of the finger on the side of the fish, close to the fin, whilst the otherwise quiescent animal was held in the open hand for examination. The vibration was started in this way several successive times, but the movements only lasted for fifteen or twenty seconds on each occasion.—H. N. Milligan.

ASTEROIDEA.

A Starfish feeding on a Spider-Crab.—A Common Starfish (*Asterias rubens*), of about 4 in. in diameter, was placed in an aquarium on November 29th last. The aquarium already contained several Edible Mussels and Purple-tipped Sea-Urchins, and also two large male individuals of the Long-legged Spider-Crab (*Stenorhynchus phalangium*). The Starfish was fed with pieces of mussel and beef. On the morning of December 4th the Starfish was found to be feeding on one of the Spider-Crabs, which was dead. It is impossible to say whether or not the Starfish had seized the Spider-Crab before death; but it may be mentioned that the crustacean seemed healthy on the previous night, and in the light of what we know of the voracity and aggressiveness of this echinoderm it may be thought not improbable that the Starfish had attacked and killed the Spider-Crab.—H. N. Milligan.

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THE ZOOLOGIST

No. 904.—October 16th, 1916.

SOME MISCELLANEOUS NOTES FROM GREAT YARMOUTH (1915–16).

By Arthur H. Patterson.

My Note-books covering the past twelve months present a leaner series of entries than has been the case for many years past. Breydon, and the marshlands surrounding here, offered neither the normal variety of even familiar species, nor any, save in a few instances, remarkable by their numbers. Something, I suspect, must be placed to the universal unrest and disturbance over broader areas than my own; besides, the military restrictions have closed to such as myself large tracts of old-time rambling haunts. As it happened, when wandering on the Denes during the Easter East Coast bombardment, I was within an ace of being arrested as "a suspicious person" by a stolid old sergeant of artillery, who required much information to even half satisfy himself; and on another occasion, when out ditch-hunting with a member of the Microscopical Society, our basket of pickle-bottles and sundry was overhauled by a much-amused sergeant and sentry. To an occasional sentry command, "You musn't go that way, guv'nor!" one has become quite resigned: my binoculars have become such a source of interest to vigilant guards that I find it best now to make the least possible display of them.

Only a few items on matters ornithological presented themselves as more than common-place: they are the "off and on"

appearances of a varying number of Crossbills, in a small fir-wood with which I am familiar; the rather more, I think, than usual number of Swallows; the low disproportionate numbers of young birds to their elders (I refer more particularly to certain Gulls) that returned to Breydon flats after the nuptial season,* and the ill-luck of those persons who put hens upon seats of eggs—to this I shall refer later on. Complaints have been made about the number of Wood-Pigeons; this year's augmented increase may be due, in a measure, to the absence of the many keepers and under-keepers called up by the military authorities, a process that may account for my easily observing a Sparrow-hawk in a locality that is ordinarily most strictly "preserved." Jays, too, would to an extent be benefited by the absence of their natural and hereditary enemies who shoulder fowling-pieces; whilst undoubtedly the game-birds, from the self-same causes, are notoriously less in numbers. As for Rabbits—I have seen fewer on my diurnal perambulations in quarters noted for them: maybe the presence of such numbers of soldiery has taught them to confine their gambols and browsing to the darker hours; mayhap, too, the same arrangement that roped in the keepers arrested the poachers, who are not insensible to the delights of camping in wild Nature's haunts (!).

It has been somewhat curious to note the effects of loud explosions on the birds. In some instances the most timid of *aves* have got quite to ignore them, whereas others have been ousted by these loud reports, and the unrest of much military intrusion. The Breydon Gulls no longer worry about the passing of aeroplanes; and I think, in a way, look for something to turn up from the boom of under-sea explosions.

The vegetation on and around Breydon has struck me as somewhat showing a process of changing. Rank rich grasses have afforded an abundant "haysel," and apparently smothered many other botanical species. Sow-thistles have been scarce on the "walls" where in some years they grow luxuriantly. The still hardening flats have, in places, produced a wider area of rank saline grasses, akin to those on the lessening "ronds," or saltings; and the *Salicornia herbacea* has been remarkably

* On this point the Breydon watcher disagrees with me; in July he thought their numbers greater than usual.

straggling and attenuated in its growth. A friend complained to me about the superabundance of water-lilies (*Nymphæa alba*) on some of the Broads. The reeds by the Waveney-side have been enormously lengthy, and the small stinging insects that haunt them have been unduly vigorous and attentive, as one has at eventide sat fishing for eels for next morning's breakfast. Wasps up to late August had never been less in number, in my experience; half a dozen at most visited me in the "Moorhen," whereas in ordinary seasons they are fussing in and out all day long. Never before, I think, had the village children been so industrious, at the proper season, in destroying nests. Butterflies have not had a good time, and the hive-bees around have become almost exterminated by a fell disease; one friend, who usually reaps a goodly harvest of honey from a dozen hives, had in August (1916) but one accidental swarm (that voluntarily came to an empty hive), and even this, he told me, was then in a very bad way. All the other swarms had succumbed.

Considering the occasional quantities of waste petrol that float to Breydon, and that naturally must settle for a time on the mud-flats until blown on a larger tide to the sides, added to the sewage that escapes thither on the flood-tide, the types of crustaceans and vermes, etc., that live on and in the ooze, still exist in wonderful numbers, although the hardening of the flats in many places makes the mud too solid for even these low forms of life to continue. But at low water and half-tide it is most interesting to sprawl low in one's punt, and watch the tiny syphons of small clams moving in a curious manner, and the out-pushing of small nereids (*Nereis diversicolor*); to see the scuttlings to and fro of the shore-crabs that are scouting around for any *Crangon vulgaris* or *Palæmon varians* that may be rarely caught napping; and then to watch the curiously crawling *Corophium*. At such times one often has the "grup"-loving Greenshank not far away, busily scooping around in search of such crustaceans as he may find in the narrow and shallow gullies, loudly prating at each small surprise.

1915.

September 10*th*.—Saw a flock of over fifty Knots on Breydon. Many Wheatears of the year now drawing to the coast.

September 15*th.*—A Landrail found its way into a cellar, where it was captured uninjured, being afterwards brought to me in a paper pastry-bag, to identify it. I think of all migrants this bird finds itself in the most curious of places.

Flocks upon flocks of Dunlins and Ringed Plovers (on this same date), with a number of Curlew-Sandpipers in their company, flying around the flats at high water; a number of Grey Plovers and Greenshanks also in evidence. So tame were many that as I rowed past them, and rattled my oars in the row-locks, they merely lifted their heads and went on with their feeding. There had undoubtedly been many successive arrivals during the past few days (*vide* 'Zoologist,' October, 1915); also hundreds of Black-headed Gulls.

September 20*th.*—Young Wheatears all over the place; up to the present date the arrivals of Redstarts and other insectivorous birds from the north had been numerously observed.

September 24*th.*—A Pelican, undoubtedly a stray, was observed on the flats by a gunner named Wigg, who disturbed it, when it rose to a great height and flew away in a north-easterly direction.

Rooks.—A flock, evidently very tired, came in on September 29th; wind N.N.W., and weather very squally, with heavy dark clouds.

October 1*st.*—A Green Woodpecker seen in St. George's Park, in the centre of the town. *Query:* Was it by any chance a migrant, or a wandering bird?

Same date.—Corvines coming over the North Sea in continuous small and straggling flocks. All seemingly tired out. Strongish northerly winds. *October* 2*nd.* Still arriving. Wind had veered round to the south.

October 2*nd.*—A flock of some dozen Godwits (*Limosa lapponica*) came to Breydon, just at closing-in time; they promptly descended from a high altitude on seeing the mud-flats. Grey Plovers still numerous, and attaching themselves to the flocks of smaller waders. Curlew-Sandpipers have been fairly numerous on the beach, a not by any means favourite resort of this species locally.

Rabbits.—Remarkably scarce just now (October 2nd), possibly owing to the over-abundant rainfall, as well as the lack of importations from the Continent. I gave one shilling and

eightpence for a threequarter-grown animal, for which, in normal times, I should have hesitated to tender a shilling.

The first week in October saw a heavy immigration of birds of various species: the night of the 4th was particularly a busy one; on the 5th Mr. Woods, the park-keeper, assured me he had that day seen three Grey Shrikes. One chased and captured a Sparrow, which protested noisily. He went to the rescue, making the Shrike drop it, when the smaller bird took the opportunity to fly away, but to no purpose, for the watchful "butcher-bird" was still on the alert, and in a twinkling had recaptured it, and flew away with it, this time making a meal of it. I have before observed that the Grey Shrike invariably arrives hungry. Two Short-eared Owls came to the Park, with many Gold-crested Wrens, Blackbirds, Redwings, Thrushes, Redbreasts. They remained a few hours, and passed on.

I have a record on the 7th that a heavy immigration of Woodcocks had taken place. One, flying against a telegraph-wire on the Quay, cut its throat, and fell dead, on the night of the 3rd. I was tempted to take a stroll along by the railway line to Caister, which runs parallel with the coast, but was rewarded only by picking up a dead Meadow Pipit beneath the wires. We had (as I had expected) a very scant list of fatalities during those night movements, the town lights being altogether suppressed after sundown; the birds flew in at a higher altitude than in normal times, when the glow of the lights on misty, darkish nights allures them to a lower plane of flight, some even to the level of the wires. I have—in years gone by—filled my pockets with chest-broken, throat-cut, and in some cases decapitated Larks, Blackbirds, and Thrushes, consoling my conscience at dinner-time by the thought that I had had no hand in their killing.

October 10*th*.—About a score of Swallows still to be seen at St. Olaves, flying up and down the cutting wherein lies the houseboat "Moorhen."

Quite two acres of Gulls on the mud-flats to-day (*October* 16*th*) Hundreds of Greater Black-backed and hundreds of Black-headed. A wretched Common Gull with petrol-blackened throat and breast disconsolately sat on the edge of the crow
of himself and ignored by them. Grey Plovers abundant.

Same date.—A Kingfisher had captured a "whitebait" (young herring) that he found resisted all his efforts to swallow. He sat perched on the handrail against my smaller Noah's Ark, and dropped it below in the grass. I found it was 3¼ in. long. A flock of migrant Larks came over at three in the afternoon.

October 18*th.*—Saw several dead Redwings on the beach, evidently birds that had been drowned on the night of the 16th. On this date I went for my annual mid-migration walk by the East Coast railway; not a dead bird lay beneath the wires. On the 21st I "did" that part of the south beach not prohibited by the military and naval authorities, finding not a single stranded migrant, only a petrol-bedraggled Guillemot.

October 21*st.*—Found on the south beach fragments of two or three small birds; a dead Rook and Hooded Crow; and a Red-throated Diver, as sticky with petrol as if treacled.

Larks and Redwings arriving freely on October 22nd, and Rooks on the 23rd.

October 25*th.*—The following carcases lying at the tide-mark: Dabchick, two Black-backed Gulls, Red-throated Diver, Guillemot, Razorbill, Puffin, Turtle-Dove, Hooded Crow.

Saw a Scoter (probably a pricked bird) sitting on the sand at the edge of the sea; on seeing me it flew out in a half-circle, and again alighted, waddled along most awkwardly, and again squatted, until I wearied of watching it. By the telegraph wires beside the railway I found a dead Pipit and two Starlings, one of which had cut off a wing completely by the force of impact, the severed member lying some inches away from the body. The other Starling had struck the side of the head, chafing the feathers off, the skin showing contusions.

October 27*th.*—A friend informed me that he had seen on that date on Breydon seven Whooper Swans and thirty-seven Geese, probably Grey-Lags; several Wigeon. He also killed several Wigeon on the 29th.

Michaelmas Daisy.—The seeds of this plant are a favourite morsel with many birds. On October 30th I observed Grey Linnets and Skylarks busy on a rond devouring them; I saw some domestic Ducks the previous week busy at the same occupation, dipping their bills in the water with every billful.

On *October* 30*th* I observed a Buzzard being badly bullied by

Gulls over the marshes; they were pursuing and tormenting him, chasing him from north to south, right to the marshes on the other side of Breydon. Two Hooded Crows joined in the squabble. It was funny to see two Gulls now and then apparently disputing among themselves in the combined chase. I had been told of a Buzzard having been seen treated in a similar fashion during the previous week—probably the same individual.

Same date.—Grey Plovers numerous on Breydon. Quite 3000 Black-backed Gulls, and hundreds of Black-headed Gulls on the flats. Many small waders. Wind easterly.

November 1*st.*—A few Starlings washed up on the beach, and much *Fucus nodosus*. A Woodcock was found dead, having hung itself in some wire-netting.

Bar-tailed Godwit.—A Godwit was brought me alive from Breydon early in September, having been shot high in the thigh, the bone being broken, and the leg hanging helpless. I could not splinter the break, so turned it into an aviary, with a handful of straw up in one corner, on which it lay for some days, without attempting to get about, although occasionally raising itself on its wing-tips. I fed it on worms; these it ate readily, and in two or three days I had tempted it to eat Spratt's chicken meal made slightly moist; snips of meat were picked out of it readily. Grubs it would not touch, nor maggots, but wood-lice were acceptable but taken daintily. In the second week it lifted itself on one leg, and hopped around, with the other limb swollen and the toes clenched. It soon limped on the rounded foot, and sat up in its corner less. By the third week in October the bone had become spliced, for the bird could then bend its limb at the "knee," whilst two toes had come out straight and pliant, the other toe still remaining obstinate. By another week the refractory toe had surrendered, and the bird walked comfortably enough. "Dick" would greet my coming with a sharp "*swe-dick!*" and chortle in a low key when he saw his saucer of meal or heard me digging for worms, soon becoming sufficiently confident to take them from my fingers. A lively worm would be passed between his mandible tips and nipped all the way along it, sometimes going through the process a third time before being swallowed, and then always head first.

"Dick" was very fond of a bath. I had hoped to keep the bird until the following migration season, when I should have released him, but he died on March 25th (1916).

Mr. G. F. D. Preston informed me, on November 6th, that he had observed flying up and down the north beach two Little Gulls (*Larus minutus*) on October 31st.

November 7th.—Saw forty Snow-Buntings.

Rooks coming over in weary, straggling flocks all the morning of November 10th; some made hard work of mounting above the chimney tops. Flying straight from east to west.

Twelve dingy-coloured Crossbills seen in a fir-wood four miles from the town, on November 11th.

November 12th.—Odd lots of eleven, three, and two Swans seen on Breydon, the weather at the time being exceedingly still, but the glass standing extremely low. Wind north. They had come no doubt "before a cold blow," or to escape one. Weather had of late been very unsettled.

Storm-Petrel brought in from sea alive on a Scotch fishing drifter, on November 13th.

November 16th.—Wild N.N.W. weather. The frost of the 13th–15th drove the Lapwings from the uplands to the lower and more saline marshes nearer town, where they are scattered all over the place. Some Snipe about; and on the mud-flats numerous Grey Plovers. The Gulls are having a bad time of it, herrings being very scarce, whilst not even a broken one is wasted.

Two Gulls flying across the Bridge from opposite directions on the 24th, at a very quick speed, very nearly collided above my head, which they would have done had not one lowered its left wing, on the instant, and the other also raised its left. Onlookers considered it "a close shave."

Wild Rabbits.—Some little larger than rats, fetching absurd prices in the market, on the 27th November. They ran from one shilling apiece to two shillings, and were rapidly enough cleared out at that price. The country folk lay the scarcity to bad weather during the breeding season, and the inflated prices *not* to their own cupidity.

A few Golden Plovers and a flock of Lapwings came in on November 28th from due east; and Rooks were passing over at

a high altitude on December 2nd, flying east to west. Snipe plentiful. A gentleman who hires a private Broad informed me, on December 2nd, that on h s water he had quite 1000 Teal, a very interesting piece of information seeing that their numbers for some years had seemed greatly on the decrease.

December 19th.—Curlews plentiful on Breydon. On December 18th I obtained a Mallard in the market. It had the head normally coloured, with a somewhat elongated beak; no white neck-ring, and no colour on the chest. Below, it was of a dirty grey, with freckled markings after the pattern of a Pochard. I sent it to Mr. J. H. Gurney, who submitted it to Dr. Ticehurst. It was thought to be some sort of hybrid.

1916.

January 3rd.—Walked across the marshes to the Breydon houseboat. Saw a large flock—some hundreds—of Dunlins.

Quite a notable inrush of mixed Snipe during the last days of the old year and the beginning of this month. A lad on the marshes shot nine Jack Snipe in a very short time, a goodly criterion of their abundance. My friend Brooks on the Belton marshes shot a Common Snipe: as it fell quite 400 got up out of a fenny corner. Using a single-barrel gun, he was naturally chagrined at the incident.

January 8th.—Several Jays and some Green Woodpeckers in a small wood hitherto rigidly preserved.

January 13th.—A somewhat disconcerting flood around Yarmouth, when the tide slithered over the banks of Breydon, breaking gaps in two or three places. Not to mention the flooding of some of the lower quarters of the town, the marshes were soon two or three feet under water: the salts joining ditch to ditch "turned up" no end of roach and small pike, which lay on the marshes when the waters subsided, to the great joy of the long-suffering Gulls and the Hooded Crows. Myriads of drowned worms afforded the Black-headed Gulls a welcome banquet, and a badly-needed one.

January 16th.—Nine Swans flew over the "Moorhen" at St. Olaves at 6 a.m. One could have hit a bird with a stone. About 100 Geese passed over my house at Yarmouth on the

24th. A flock of sixty Geese that passed over the "Moorhen" on the 23rd flew in wedge-form, a single bird leading. Whilst still flying north-east, the first five or six dropped out, fell back, and others pushed forward to replace them, the tired ones dropping into position and still keeping that triangular form.

Mistle-Thrushes plentiful in the neighbourhood, one piping daily, third week in January, on a tall tree-top in the centre of the town. Two cocks fighting lustily in St. George's Park on February 1st.

February 26th.—From 250 to 300 Wigeon on Breydon, in one flock, passing over to sea, on being disturbed, in a fan-shaped flock. Considerable muster of Knots, with some Ringed Plovers and Redshanks.

Coots are realising good prices in the market, readily selling at eightpence and ninepence each. Wild Ducks selling at half-a-crown each. Fourpence was the old regulation price for Breydon-shot Coots in the days of yore.

Two Snow-Buntings on the beach as late as March 26th.

March 30th.—A dozen Geese, presumably Grey-Lags, on Breydon. Saw a Black Redstart, same date, hunting on some rails near my Breydon Noah's Ark.

Several Sheld-Ducks, and about 200 Wigeon on Breydon, April 1st.

Entry for April 2nd.—"Last week a 'large Hawk' seen by Mr. Brooks, at Belton, chasing a Wild Goose on the marshes, when the quarry came within a few feet of a gunner, who fired at it. Being so close he missed the bird, and distracted the 'Hawk,' which was without doubt a Peregrine Falcon."

Snipe numerous on the Suffolk lowlands. Put up several from a rond on April 2nd, at St. Olaves; find they are all over Herringfleet, and parts of the Belton Marshes, and "drumming."

My friend Mr. H. E. Hurrell informs me that when cycling near Hopton on April 1st he heard the call of the Cuckoo.

The Rooks' nests in the trees overlooking the Market-place now number some twenty; those in the churchyard trees number thirteen.

April 15th.—Saw a Sabine's Gull on Breydon, being attracted to it by its Tern-like flight. The back was darkish-grey, head perfect, and tail distinctly forked. Wind boisterous and cold.

April 26th.—About sixty Knots in one bunch on Breydon. Every one as grey as in mid-winter; undoubtedly birds of last year's hatch. I noticed that the Godwit—confidingly tame—not infrequently wrings and pushes his mandibles so deeply into the ooze as to mud his forehead.

Saw a nice muster of Shovellers on the Broads in the vicinity of Catfield on April 27th. Got to within forty yards of a couple who were watching my movements in turn. Brimstone butterflies very numerous.

May 8th.—Unpleasant morning; saw two Swifts.

May 11th.—On Breydon observed two Sheld-Ducks, an Oyster-catcher, and many Whimbrel.

May 12th.—Saw eleven Lesser Black-backed Gulls, all in one flock by themselves on the flats; six were adults—"like pictures"; two were third-year birds, and three were last year's birds. Many Little Terns, in pairs, on Breydon.

Two Spoonbills had been frequenting Breydon, off or on, week ending May 19th.

May 23rd.—Spent a rather weird night on Breydon. Caught about sixty eels (captured 108 night before), the stillness of the night being punctuated by the croak of a restless Heron, and the sharp, clicking "*wick-wick*!" of the Godwit, and then seeing at intervals a searchlight stabbing the dark skies with unexpected suddenness.

May 24th.—Observed a Little Tern twice or thrice poising itself easily in the air, putting a stray wet feather in its place when on the wing, with its beak almost parallel to its body.

Heard the Whimbrel on Breydon as late as May 24th. Next day I observed Rooks, young and old together, progging on the mud-flats. A half-score Curlews still there.

A considerable flock of Common Gulls on Breydon on June 26th, mostly adults. This species is the slowest and least demonstrative of the family that haunt the mud-flats, spending a good deal of its time preening its feathers, and in sleep.

June 29th.—On the borderland of my beat there is a little fir-wood, backed by an undulating heath bright with heather and rich with the green of the bracken, fore-fronted by a strip of fenny land, from which it is divided by a long ditch beloved

of Kingfishers, and on occasion Wild Mallard and Duck, tempted thither by a flock of my friend the gardener's tamed pinioned wild-fowl. On this date that bit of fen is gay with ragged robin, "cotton-plants," forget-me-nots, and the dwarf yellow rattle. The wood covers some six acres, and trends, in the westward, down to the marshes. It is lively with birds; during the week four Hawfinches—probably nesting in some obscure corner—have been flying around; numbers of Goldfinches and some Bullfinches, with two or three pairs of Red-backed Shrikes, haunt the place; to these may be added seven or eight Crossbills in green and red, a half-dozen Jays, and plenty of Nightjars. This evening as I stood revelling in the spot, I heard the soothing croon of Turtle-Doves, their soft mournful cooing creating at length almost a feeling of monotony. A number of alders share with the firs this delightful area, whilst a bordering of oaks shuts in the far side. I seldom pass that way but I spend a short pleasant while in their shadows. This unnamed place is now a little paradise: and I hope the energetic keeper has gone to the war.

June 30th.—I am of opinion that the Swallows and House-Martins have been more plentiful than usual hereabouts; Sand-Martins much scarcer, and Swifts and Nightjars well up to the average. Two pairs of Bearded Tits appear to have lived this summer in a Waveney reed-marsh.

Three Herons, over from Holland for a short spell, flew in on July 13th, going direct west at 8 a.m. Lowering as they came in, they were set upon and mobbed by a number of Gulls.

On the night of July 13th I sat eel-fishing beside a reed-bed on the Waveney; at 10 p.m., in the dusk, an Owl flitted across the reeds, disturbing a Sedge-Warbler, that darted after the bird of prey with much noisiness and a great show of anger, pursuing it out of sight and hearing.

Spoonbills.—When sailing my punt on Breydon I put up a Spoonbill that had been standing belly-deep in water at the edge of the Ship Drain. The bird's breast was richly saffron-coloured, and the crest of fairly good dimensions. Three were here during the second week of July.

There had been for several days a Scoter frequenting Breydon, where it was to be seen diving, and coming again to the surface

holding a kicking shore-crab (*Carcinus mœnas*) in its bill, which it promptly smashed up and devoured.

July 21*st.*—Redshanks numerous on the mud-flats. At the end of July Sparrows were particularly attentive to spiders, after which they hunted around windows, gates, etc. A friend assured me that the Sparrows paid great attention to his garden peas, but he was emphatic they were after insects; another person noticed these attentions of the Sparrows, but condemned them as pea-pilferers.

Swallows just after sunset, in July, have a method, very like the Swifts, of rushing around in flocks, capturing what I take to be the gnats and mosquitoes among the reed-tops, just previous to retiring for the night.

There are apparently two black Water-Voles haunting my ditch.

On August 3rd I saw the forsaken nest of a Moorhen at the end of a ditch black with filthy scum, the receptacle of the drainage from a "cow-parr."* The young birds must have taken their early swims to the great detriment of their little jackets. It is odd that with the choice of many acres of clean reed-bed hard by, the parents should have selected such a situation; possibly the insects swarming there may have been the inducement.

The only Green Sandpiper I have heard this autumn passed over the "Moorhen" on August 6th.

About a score Crossbills at Belton on August 8th. Same date a Golden Plover passed overhead.

Herons still visit the Fritton Woods. A friend when fishing observed a Heron alight, apparently in the water, on the margin of the lake. Knowing that the water is deep all round, he soon solved the enigma by discovering the bird had alighted on a submerged snag or bare tree-branch that had fallen into the water. From this post of vantage the Heron lay wait for giddy young rudd that toyed at the surface.

There is a small pig-sty, notorious for its ooze, in a village hard by, wherein the old sow wallows leg-deep. Above her equally obscene sleeping-room, not three feet from her, a pair of Swallows had built their nest, another apparent instance of avine disregard for a sweet and cleanly home.

* A "cow-parr" is Norfolk for a drainage corner of a cow enclosure, a low corner of a "cow-yard."

During a very dry spell in early August, several Common Snipe visited Breydon flats, an event that happens only when the dry marshlands are utterly unable to provide these birds with food.

August 24th.—Several Greenshanks in Breydon.

On close sultry days, as on August 24th, Starlings have a curious habit of copying the Swallows, by following some of their insect prey, and snapping them up on the wing overhead. This afternoon some species of insect, whether *Diptera* or *Coleoptera* I could not ascertain, had tempted them to sail round and round, now on parachutic outspread wing, now suddenly checking themselves and briskly hawking after one that had escaped. Their mandibles could be seen to snap at victims that one could not distinctly discern.

The hatching-season in my area would seem to have been a bad one, so many chicks dying in the egg. My neighbour the farmer at St. Olaves, who usually puts down twenty or thirty hens, lost whole clutches, or only had a few odd birds hatched off. I found similar complaints all round the neighbourhood, the general opinion being that the concussion in the air caused by falling bombs, and also a certain bombardment, which made the very houses vibrate a few miles inland, had not a little to do with the failure. I heard complaints in opposite quarters: I do not know if one may accept this suggestion. Jary, the Breydon watcher, assures me that very few young Terns have been seen on Breydon this early autumn, as is mostly the case, but he was emphatic on the point that young Black-headed Gulls had been very plentiful in the end of July.

August 26th.—The town Sparrows are all gone a-harvesting in the country; even my lot no longer come for Mrs. P.'s waste bread-pieces. This bird would seem to be exceedingly partial to the great dragon-fly, which it will pursue with some zest, and on capturing it deftly bites off the wings, and then devours the carcase. What insects the Sparrow will not eat would make a shorter list, I think, than that of those it delights in. There are times when spider hunts on sand-dunes, where ground hunting-species resort, are quite a paying recreation for these indefatigable little creatures.

Black-backed Gulls.—There is still a considerable sprinkling

of adult Greater Black-backs on Breydon. They are keen on carrion, fish-food having been none too plentiful with them. Yesterday Jary saw a big fellow perched on the putrid carcase of a big dog, eating heartily as this queer raft floated him alongstream. The other day there was a regular stand-up fight between two strong birds, beginning with a dispute over some stranded morsel. They went at it "hammer and tongs" with much noise and posturing, one at length seizing the other by the nape of the neck, holding on to him determinedly, feathers flying as they struggled. By the end of a quarter of an hour some others had come up and had started on the twain, separating them, afterwards pursuing the tentative victor all over the flats awing. These birds are keen on shore-crabs; the latter, when stranded on the flats by the fall of the tide, hide beneath the *Zostera* and the "cabbage-weed"; this, the Gulls, in extended order, toss over as they walk along the flat, finding, crushing and swallowing the crabs with some show of intelligence and success. A shrimper who had returned with his catch had occasion to go home with a hamper of sorted shrimps, leaving a big basket of the unsorted. In his absence the hungry Gulls had discovered them, and had swooped down upon the shrimp-boat, and by his return had devoured nearly all of them.

During the summer three Cormorants had spent much time on Breydon eel-catching. One bird brought to the surface one largish eel as big round as an egg-cup, when some Gulls set upon him. He immediately dived with it, the fish coiled round his mandibles, and presently came up again, having either swallowed it below-water or lost it.

My friend Mr. C. G. Doughty, now of Gorleston, sends me some interesting notes. When staying at Southwold last October, he, on the 4th, observed an immigrant Redbreast fly towards the pier, but fall into the sea before reaching it. After floating some minutes with outspread wings, it rose again and flew out seawards, and was lost to view, probably drowned in its bewilderment. Wind was north-east. A Sparrow-hawk, and what he believed to be an immature Black-Throated Diver, were found on the beach after a storm.

The following birds were picked up on the sands between Gorleston and Corton:—November 8th, a Coot; November 18th,

Common Scoters, a few days later, and on February 18th, April 8th, and one on a later date were found, four immature but in good condition, with nothing to account for their demise. One bird was an old male, very emaciated and faded in colour, suggesting old age. November 20th, Storm-Petrel; November 24th, Little Auk; Short-eared Owls seen on November 23rd, and later; December 5th, Bridled Guillemot found alive, but feathers on one side much clogged with petrol; January 3rd, Velvet Scoter; March 9th, a Puffin; March 29th, a dead Plover and a Starling, after the great blizzard.

March 18*th*.—Fine and warm, no wind. Large numbers of Rooks, with Jackdaws, observed at Yarmouth migrating, between 12 noon and 12.30. They flew in an apparently tired and purposeless manner, at no great speed. One flock of them appeared to dislike the venture, and turned back awhile.

March 21*st and* 22*nd*.—Strongish north-east wind. Several Larks', Starlings', *Turdidæ's* (probably Redwings') and Rooks' sternums, with wings attached, lying at the tide-mark, suggesting disaster on the outward voyage. March 25th, a dead Blackbird.

Sanderlings frequented the beach all winter, sometimes a single bird being seen, sometimes two or three, occasionally five, and once seven. They were first observed on November 10th, and vanished on May 4th. Ringed Plovers seen April 8th, and onwards.

A Stonechat seen on the Golf Links and Parade all the winter; two joined him on February 26th, when snow lay on the ground.

A few years since a condemned fishing-smack was towed a mile or so up Breydon, and stranded on a convenient spot near the walls to be broken up by a marsh farmer. All the upper parts and sides were removed, and the kelson and lower ribs left, these becoming in time coated with silt. Three years since the farmer's men threw out this accumulation of mud, and removed whatever else was negotiable. The long ridge of mud hardened; to-day the top stands above the level of spring-tides, and is a favourite resort of small waders when "washed off" the flats.

On August 31st I rowed, with my old blind chum Dye, up-stream on top the tide, when my attention was arrested by

quite a menagerie of waders, most of them asleep upon the ridge. I quanted to the edge of an adjacent rond, and lay for some time watching them, at intervals pushing nearer, until I was within twenty feet of the crowd. It was a bonnie sight! Twenty-five Knots, mostly greys, with here and there one with a fawnish-tinged breast; thirty Curlew-Sandpipers, some still ruddily-tinted below; half a hundred Dunlins, several of which had the black patch on the breast as perfect as in spring; and several Little Terns, the old ones flitting to and fro after young herrings that, up to three inches in length, they brought back with them, to be snatched by a hungry youngster whose appetite never for long seems to be appeased. Presently I pushed the boat's nose into the heap, when all the crowd took to wing, but as I lay prone and still on the forepeak, my chum crouching in the well of the punt to "listen," they flew in again and alighted, when I could have thrown the proverbial salt upon their tails. I found patches of rond-grass growing, with tufts of *Salicornia herbacea*, and a closely allied plant flourishing in sufficient abundance to make that mud-ridge picturesque. I am afraid that on the morrow a wily old hand-gunner of my acquaintance haunted that spot, as often aforetime he has, to the disturbance of my tame and unsophisticated little friends in autumn-tinted feathers that had piped to me, and showed me how they slept and gossipped, bathed, and hunted aggravating parasites. Why can't men let them alone to live their ways, as I do?

There was one small Sandpiper who gave me twenty minutes' hard puzzling; he was asleep, showing me only his stiff compactly-bunched back, and a suspicious tail-feather or two: but for the place and company I found him in, I should have declared him a Wood-Sandpiper. I still think that such was he; and an odd glimpse or so of his head and bill, as he readjusted his sleeping position, still further justified my supposition. There was, too, a pronounced call like "*Giff! Giff!*" as the crowd bunched in their hurried flight. You never know your luck on Breydon, and can mostly prepare yourself for surprises and for tantalisation.

ORNITHOLOGICAL REPORT FOR THE MALTESE ISLANDS (JULY–DECEMBER, 1915).

By G. Despott, M.B.O.U.,
Nat. Hist. Museum, Malta.

The Maltese Islands, owing to their position almost in the very centre of the Mediterranean, and forming, as has often been stated, a stepping-stone between Europe and Africa, are surely to be considered an ideal point from which to make observations and issue a report on Bird-Migration. Several friends have promised to assist me in this work, and some have already given me many valuable notes for the compilation of the present report. Amongst these I may mention Mr. L. Cachia Zammit, Col. Francia, Mr. F. S. Gera, Prof. Vassallo, LL.D., Mr. A. Vassallo, P.A.A., and Mr. J. Zammit, P.L., to all of whom I must tender my heartfelt thanks.

During these six months the following were the most important occurrences:

(1) A Short-toed Eagle (*Circaëtus gallicus*), taken in the neighbourhood of Wardia in the first week of October; this is the only living specimen I have seen taken in the island. There is a stuffed specimen in the Nat. Hist. Museum, and another was in the collection of the late taxidermist Mr. G. Micallef, which was shot in Comino about twelve years ago. Schembri says that this species, which is rather rare and does not occur

annually, usually appears during August and September. Wright says that a specimen in his collection was killed in Gozo at the end of August, 1857; this is perhaps the specimen which is preserved in our Museum.

(2) A young female Peregrine Falcon (*Falco peregrinus*) was shot in Wied il Buni by my friend Mr. L. Cachia Zammit, who was good enongh to send it to me. This is the only specimen which I have seen in the flesh; I know, however, of other, stuffed, specimens which have been taken in Malta. According to Schembri, the species was rather common in the island during his time, and was also one of our breeding species. (The bird which bred here is very probably the *Falco peregrinus brookei*, which is the Mediterranean race.) Wright does not state its frequency here, but from his list it does not appear to have been very rare; certainly its rarity to-day is quite unquestionable, and so I have no hesitation in putting down the present occurrence as one of exceptional importance.

(3) An exceptional passage of Honey-Buzzards (*Pernis apivorus*) which have lately become rather scarce, occurred on September 15.

(4) A Short-toed Lark (*Calandrella brachydactyla*) was taken on December 2, an exceptionally late date for the occurrence of the species in Malta.

(5) The nesting of a pair of Spanish Sparrows (*Passer hispaniolensis*) late in November, a case perhaps unique.

(6) The Black Redstart (*Ruticilla titys*), which is a rather scarce visitor, was pretty common during this season.

(7) Late in December, amongst the Adriatic Gulls (*Larus melanocephalus*) taken, there were two ringed specimens marked M.K. Ornith. Közpout, Budapest, 5358, and M.K. Ornith. Közpout, Budapest, 5573.

July.

During the whole of this month the most common species were the Spanish Sparrow and Sardinian Warbler; next came the Spectacled Warbler and Short-toed Lark. Sparrows' nests continued to be rather common up to the middle of the month, and even during the last week of it I found a nest in which eggs were still being laid.

2nd.—The sky rather cloudy, with a fresh wind blowing from the W.N.W. I observed a flock of seven Curlew-Sandpipers flying along the western coast of Marsascirocco harbour.

6th.—A very light wind from the N.N.E. A Redshank passed to the north.

14th.—Wind S.S.E., almost calm. I observed an Osprey hovering high at a distance of about three miles off Delimara Pt. I was also told by some fishermen that the bird had been frequenting the same locality for at least a fortnight before.

20th.—A fresh wind from the N.W. Saw, for the first time in the season, a Kingfisher.

28th.—A light N.E. wind. I went to Filfola by the way of Wied-iz-Zurriek, whence I took a boat. On my way there I observed that the Petrels, which were pretty abundant, were flying in an easterly direction; in the afternoon they could be seen coming from the east. Some alighted on Filfola; several, however, continued on their way to the west, from which quarter a fresh wind was now blowing. On this occasion I found that there were very few Shearwaters on Filfola; some had young, others had fully-incubated eggs. The Petrels too had young and eggs. Besides these birds the only other species I saw were three Sardinian Warblers and one Subalpine Warbler; this had a nest containing four young almost ready to fly.

AUGUST.

2nd.—Almost calm, S.S.E. I went along the southern cliffs for a distance of seven or eight miles, where I observed eleven Blue Rock-Thrushes, some Rock-Pigeons, two Sardinian Warblers, and some Sparrows.

5th.—A fresh wind was blowing from the N.W. A Kingfisher was taken in Marsascirocco bay; this might have been the individual seen on the 20th ult.; at least a fisherman told me that he had seen the bird for two weeks.

7th.—A light north wind. Three Short-toed Larks came in from the sea; these I observed while I was in a boat off Binghisa Pt.

10th.—Almost calm, weathercocks pointing to the N.W. A pair of Kingfishers entered Marsascirocco Bay, seemingly to establish themselves on the fish-ponds.

18th.—Almost calm ; weathercocks still pointing in the same direction. A Curlew passed to the south early in the morning.

17th.—A very light N.N.W. wind. Flocks of Short-toed Larks continually coming in from the sea.

19th.—A light north-westerly wind. A Curlew passed against the wind early in the morning.

20th.—Almost calm, N.N.W. Many Grey-headed Wagtails (amongst which were some Short-toed Larks) came in from the east.

23rd.—A fresh wind blowing from the N.N.W. ; a little shower every now and then. During the morning several Short-toed Larks and Grey-headed Wagtails came in from the sea ; amongst them I observed several Black-headed Wagtails. In the afternoon I saw two Hoopoes, the first I observed during the season.

24th.—Wind moderate, a very light shower. Short-toed Larks and Wagtails continued coming in from the sea. I observed that while the Wagtails alighted, the Larks continued their way against the wind. Five Swallows came in during the day.

25th.—A slight shower. Several Swallows and one or two House-Martins.

26th.—Wind blowing moderately from the N.W. A Curlew passed in the morning to the S.W. Wheatears were observed arriving during the afternoon.

27th.—The wind blew somewhat lighter from the same direction. Several flocks of Curlews, composed of from three to seven individuals, passed to the south. Along the barren rocks of Binghisa there seemed to be quite an inrush of Wheatears.

28th.—A perfect calm. Of the Wheatears seen yesterday not one could be observed to-day ; a Sparrow-Hawk was seen passing to the S.E. (I was told that many Wheatears were exposed for sale at the Valletta Market.)

29th.—A very light wind blowing from the S.S.E. In the clear moonlight I could observe distinctly several Ringed Plovers running over the sand at Birzebbugia, and continually picking up something ; they were probably feeding on the Sand-hoppers and other small crustaceans so common on that sandy beach.

30th.—The wind continued to be very light, blowing, how-

ever, from the W.S.W. Small flocks of Wagtails came in from the sea during the whole day.

31st.—A light wind from the N.N.W. A Common Tern came over from the S.E.

SEPTEMBER.

2nd.—Almost calm; weathercocks pointing to the E.N.E. some Quails were taken during the morning.

3rd.—Wind very light, blowing from the S.E. Quails were taken in rather large numbers. I observed a Hoopoe and several Dotterels, these passing to the S.W.

5th.—A moderate N.N.W. wind. Wagtails and Short-toed Larks passed to the S.W.; several Turtle-Doves passed also in the same direction. A Curlew was seen in the afternoon passing over to the west. About an hour before sunset a Woodchat came in from the sea; it was shot by a so-called sportsman directly it alighted on a branch of a carob-tree at the mouth of Wied il Buni.

6th.—Almost calm, weathercocks pointing to the N.N.W. A good number of Wagtails came over from the east, while the Short-toed Larks were observed going out in the opposite direction. During the day there appeared a very sensible diminution of Sparrows, which up to this date could be seen, relatively abundantly, on the roofs of farmhouses.

7th.—A light N.W. wind. Wagtails and several Curlews passed over to the west.

8th.—Wind blowing moderately from the east. Flocks of Turtle-Doves came in with the wind; of these several were taken during the morning. Curlews passed, very high, in a westerly direction, probably without alighting. Seventeen Cranes were seen on the barren rocks at Binghisa, and one of them was killed; towards sunset five Purple Herons came over from the north; they hovered for nearly an hour over Wied il Buni, where they at last alighted; before dawn they all flew towards the south.

9th.—The wind changed to a very light E.S.E. Twenty Turtle-Doves passed over to the south; seven Herons passed in the same direction; two Curlews were seen towards sunset passing over from the S.W.

10th.—Almost calm, weathercocks pointing to the S.E. Only

some Turtle-Doves and Wagtails; the majority of these were taken in the clap-nets.

11th.—A perfect calm, so much so that I could not mark the direction of the wind; the birds seen consisted of some Quails, several Dotterels, Wagtails, and Terns. Many Wagtails were taken, especially towards noon. I noted two Curlews passing over to the S.W. and two Hoopoes, which came in from the east. During the afternoon, passing through Wied Zembak, I flushed three Nightjars and one Purple Heron. We had a shower to-day.

12th.—A light wind from the N.N.W. Only some Wagtails and Quails; to-day also we had a very small shower.

13th.—Wind continued from the same direction, but blowing moderately; two Redshanks came over with the wind. Heard the shrill note of the Wryneck.

14th.—The same wind. Many Wagtails came in, amongst which great havoc was wrought both by fowlers and the so-called sportsmen. One of these killed thirty-four of them in a single shot, from the canes at the bottom of Wied Zembak (Wagtails and Starlings seem to be particularly attracted to the canes in this locality).

15th.—A perfect calm. Buzzards passed in fairly good numbers all the day long, but towards the evening especially. Some were also taken; I procured one specimen, which I stuffed.

16th.—Almost calm; only a few Wagtails.

20th.—Perfect calm; two Skylarks, apparently the first arrivals.

24th.—A light wind blew from the east. I observed a few Skylarks, amongst which there were also a few Calandra Larks.

25th.—Wind blowing moderately from the E.S.E. A Woodcock was shot at Wied il Koton; this seems to be an exceptionally early date for the occurrence of the Woodcock in Malta.

28th.—A fresh wind from the N.N.W.; a solitary Starling came in from the sea.

29th.—A light wind from the N.W. A few Skylarks and some Finches; also some Titlarks and a few Tawny Pipits.

October.

4th.—A perfect calm. Greenfinches arrived in fairly good numbers, so many, in fact, that netters began to look forward to

a plentiful passage of Finches. (As we shall see further on, however, their expectations were not realised.)

6th.—Almost calm. Weathercocks pointing to the N.N.E. A flock of eleven Chaffinches came over from the S.W. Six of them were taken by a netter in Binghisa.

7th.—A light wind from the N.W.; two male Chaffinches taken. These were the only ones seen.

10th.—A moderate wind from the S.W. A few Greenfinches; some taken.

12th.—A moderate wind from the east. I saw the Robin for the first time during this season.

14th.—Wind continued blowing from the same direction, but very mildly. Redstarts, Nightingales, and several species of Warblers, which generally visit us during the last week of September, were only noticed to-day; and in spite of an Act protecting them, many were taken and very probably exposed for sale in the Valletta Market.

16th.—The same wind blowing moderately. Stonechats, Titlarks, and Tawny Pipits.

18th.—The wind, blowing very mildly, turned to the S.E. Several flocks of Starlings passed over towards sunset in a northerly direction.

19th.—The wind changed into a fresh N.W. Two Sparrow-Hawks were observed passing over to the S.W.

20th.—Wind the same both in force and direction. Larks came in from the sea in fairly good numbers. A Siskin was taken at Zurrico.

23rd.—A very light wind from the N.W. I saw a Hawfinch and some Tawny Pipits.

25th.—A fresh wind blew from the E.S.E. till 2 p.m., when it changed to a S.W. Sky cloudy. Large flocks of Larks began to arrive in the afternoon. These continued to increase both in number and frequency towards sunset. During the night the fields must have been full of them; on the following morning, however, only a few could be seen.

26th.—Weathercocks pointing to the east; not the slightest breeze, however, could be felt. Two Dotterels and some Larks were seen during the morning. Large flocks of Larks passed towards sunset in a north-westerly direction.

27th.—During the morning weather was rather foggy, and we had a perfect calm; heard several times the note of Curlews. In the afternoon the wind blew moderately from the S.S.E. when a few Greenfinches were seen coming over from the east.

28th.—The wind turned to the S.S.W. and continued of the same force. The morning was rather foggy. Song-Thrushes arrived during the night.

29th.—A very calm morning, on which only two Larks were noticed; these came over from the N.E. In the afternoon the wind blew moderately from the N.W. Many Skylarks and Titlarks came over from the S.E.

30th.—Wind very light, direction varying from N.W. to S.W. We had a good passage of White Wagtails and some Linnets. Scops Owls were taken at Wied Zembak.

NOVEMBER.

1st.—A light S.W. wind. Passing through Wied Zembak, I met a man who had killed eleven Scops Owls, and I learned from him that he had taken twenty-eight of these birds the day before. The only birds I noticed along the whole valley were three Robins and two Blue Rock-Thrushes.

2nd.—Almost a perfect calm; weathercocks pointing to the S. and S.E. Large flocks of Skylarks began to arrive at about 3 p.m.; they all came in from the east. Very few were taken; the majority must have continued their journey onwards, as the following morning very few were to be seen.

4th.—Wind moderate, blowing from the N.W. The birds observed were some Linnets and Titlarks, seven Chaffinches, and many White Wagtails; many of these were taken in the nets.

5th.—A light S. or S.E. wind. Nothing seen except some Scops Owls.

7th.—Almost calm. Mr. Cachia Zammit shot a Peregrine Falcon, which he sent to me; it now forms part of my collection. I was told that a few Chaffinches were taken.

10th.—Some Larks and Titlarks were brought into the Valletta Market.

11th.—Two Woodcocks at market.

15th.—The Linnets which had gathered in our valleys since

their first arrival began to be taken by means of the bat net, so that there soon appeared a very sensible diminution of these birds.

17th.—Some Plovers and Dotterels were the only game to be seen in the Valletta Market.

19th.—A few Lapwings.

20th.—Plovers and some Woodcocks.

21st.—A fresh wind from the S.S.W.; we had also a little shower. I saw two Firecrests at the railway station at Birchircara.

22nd.—A very light S.W. wind. I saw five Firecrests at St. Antonio Gardens, also some Linnets, two or three Chaffinches, and a good number of Sparrows.

26th.—A thunderstorm of exceptional intensity passed over the island during the early hours of the morning; the rain continued almost all day long. Firecrests appeared in abundance, and apparently they were the only birds noticed.

28th.—The wind blew rather strongly from the N.W. I saw a Firecrest in the Maglio and two Blackcaps in the Argotti Gardens. A Coot, four Quails, and three Plovers were brought into the Valletta Market.

29th.—The wind, which was rather mild, blew from north to east; we had a fall of temperature. Plovers and Woodcocks were taken.

December.

Unless otherwise stated, all the birds noted during this month were seen at the Valletta Market.

1st.—It was reported to me that a flock of twenty-seven Cranes were seen coming from the north; they alighted on the rocks in the vicinity of Naxaro. One was shot near the Salina. Woodcocks, Lapwings, and a few Larks at market.

2nd.—Lapwings and Golden Plovers (these in very limited numbers), many Song-Thrushes, two Blackbirds, two Mistle-Thrushes, one Horned and one Little Grebe, many Skylarks, amongst which I found a Short-toed Lark; this is in my opinion a noteworthy occurrence, in fact, I have never before seen a Short-toed Lark so late in the year.

3rd.—Few Plovers, Woodcocks, Larks, and Thrushes; also one Great Plover and one Horned Grebe.

4th.—Few Quails, Woodcocks, Lapwings, and some Golden Plovers.

6th.—Some Quails.

7th.—Some Quails and one Common Heron.

8th.—A light wind blew from the S.W. I went to Melliha with Col. Francia. The only birds I observed were one Hawk, one Lapwing, a few Larks, and about thirty Adriatic Gulls. On our way back I saw some Linnets and three Black Redstarts.

9th.—Some Quails and Larks, also a Shelduck.

10th.—One Mistle-Thrush, two Plovers, twelve Quails, and some Larks.

11th.—I noticed three Black Redstarts at the Argotti Gardens and two Firecrests at the Maglio.

A very light wind from the S.W.; cloudy. At the Valletta Market there were only five Quails, two Song-Thrushes, and some Larks.

12th.—At market five Quails, some Larks, and one male Black Redstart.

13th.—Some Quails and Larks, one Plover, and one Song-Thrush were brought in by the bird-fanciers on St. John's Square.

A light southerly wind. Many Adriatic Gulls were seen passing over towards the north.

Five Song-Thrushes, one Woodcock, and fourteen Golden Plovers were the only birds I saw at the market.

14th.—A few Larks and two Song-Thrushes. I saw one Black Redstart and two Firecrests just outside Floriana.

16th.—One Water-Rail, some Quails, several Skylarks, and two Black Redstarts.

Seven Dotterels, two Golden Plovers, two Quails, and some Larks.

17th.—One Great Plover, two Quails, two Larks, about two dozen Titlarks, and two Black Redstarts.

18th.—Two Song-Thrushes and a few Larks.

19th.—A moderate wind from the S.S.W. We had an abundant passage of Golden Plovers and Dotterels.

20th.—The birds brought into the market were the follow-

ing: Thirty-two Golden Plovers, two Dotterels, two Song-Thrushes, one Moorhen, one Scops Owl, and some Larks.

21st.—Thirty-four Quails, two Dotterels, and a few Larks. I saw a Black Redstart at Hasting's Gardens, Valletta.

22nd.—Two Golden Plovers, two Dotterels, and a few Larks.

23rd.—Two Quails, some Larks, and one Black Redstart.

24th.—Two Quails and five Larks. I saw a Firecrest at the Lower Barracca.

26th.—Three Quails, one Song-Thrush, and some Larks.

I saw a Redstart at Sliema.

A very light wind from the W.N.W. Many Adriatic Gulls and some Southern Herring-Gulls passed very high over Valletta.

27th.—A moderate wind from the N.W. Some Gulls passed, against the wind.

There were some Gulls at the market, amongst which I found one bearing a ring with number 5573.

28th.—Many Adriatic Gulls passed very low over the town.

29th.—I saw a Black Redstart, two Subalpine Warblers, and one Spectacled Warbler in the ditches round Valletta. Another ringed Adriatic Gull (No. 5358) was found among the Gulls exposed for sale at the Valletta Market.

30th.—Almost calm. I saw a Firecrest and two Chiffchaffs at the Lower Barracca.

31st.—An exceptionally large number of Adriatic Gulls, also some Southern Herring Gulls, in Marsamuscetto Harbour.

SOME GERMAN ENCHYTRÆIDS.

By Rev. Hilderic Friend.

Shortly before the outbreak of war I was visiting Belgium and Germany, and during a week spent at Neuwied on the Rhine had an opportunity to collect a few of the annelids (Oligochæts) of the district. Most of the species enumerated in this paper were found in the grounds attached to the Schloss, but others came from the woods and fields of Niederbieber, Oberbieber, and the adjoining villages. I confine my remarks to-day to that group of Worms which is known as Enchytræids. They are usually white-blooded, and vary from 3 to about 25 mm. in length. These white Worms are exceedingly numerous in England, and it was my wish to ascertain how far the same species might be found on the Rhine as occur with us in this country.

As the genus *Fridericia* proved to be the most common, it may be well to begin with a description of the genus and then proceed to enumerate the species found. The genus *Fridericia* consists of Worms which average one-half to three-quarters of an inch in length. They have setæ arranged in four bundles on each segment. The number of setæ in each bundle, while almost entirely uniform for the species, varies widely within the genus. Some invariably have two setæ per bundle (bisetose), some have four, some six, and some eight. Usually the number decreases

towards the posterior end, except in the bisetose species, so that a form which has six setæ per set in front of the girdle may have four, three, or two in the tail. The setæ are shorter in the middle of each bundle than at the outside. The girdle is on segment twelve, the spermathecæ are in the fifth segment, and often possess diverticula. There are salivary glands behind the pharynx, and the brain is almost invariably convex behind. The microscope is absolutely necessary for determining the species.

1. *Fridericia michaelseni*, Bret.

This worm was first described in 1899 by Bretscher (1) from specimens found in Switzerland. Michaelsen (2) the following year included it in his Oligochæta but added no further reference. Ditlevsen (3) recorded it in 1904 for Denmark, and I have made many allusions to its occurrence in this country. It is one of the most widely distributed species. *F. michaelseni* frequently reaches $\frac{3}{4}$ inch in length and is stout and active. The setæ usually number six in front, decreasing behind to four, three, or even two. The spermathecæ have a duct which usually exceeds the diameter of the body in length, and there are three or four round diverticula. In the Swiss examples a large gland was found at the external opening of this organ, but Ditlevsen failed to find it in the Danish as Southern did in the Irish forms. In England there is great variation in this respect; sometimes no gland is present, at other times a gland occurs on one side of the body only, while in yet other instances the large gland is found attached to the opening of each spermatheca. The German forms collected by me were possessed of glands. My notes are as follows:

Length 20 mm., segments 65. Dirty yellow-brown. Setæ 6 in front, 5–4 behind. Spermathecæ with long duct, four diverticula, and large gland at the opening. Large male pores on the girdle, which extends over segments 12 and half 13. Dorsal vessel arising very far back, about segment 24 or 25. Brain one and a half times longer than broad, straight or concave in front and convex behind. Sperm-funnels about three times as long as broad, with a distinct but narrow collar. Fully mature

in July. Oberbieber to Braunsberg, and Schloss Grounds, Neuwied on the Rhine.

2. *Fridericia perrieri*, Vejd.

This is a smaller Worm than the last. It was carefully described and illustrated by Vejdovsky (4) in 1877 and again (5) in 1879, and has since been often reported. It occurs in Denmark, Switzerland, Italy, Bohemia, and Great Britain, and has been recorded for Hamburg and elsewhere (3). It is quite as frequently found in this country as *F. michaelseni*, and has been familiar to me for many years. My record is as under:

Length 8–12 mm., segments 38–50. Setæ usually 6 in front and 3 behind. Spermathecæ with two stalked diverticula, long slender duct and no glands. Dorsal vessel arising in or near segment 1/8 and pulsing forwards, especially about the sixth segment. Brain projecting in front and convex behind. Salivary glands branched. Sperm-funnels somewhat small, pear-shaped, with a distinct collar and fairly stout duct. Nephridia with duct arising near the septum. Found among beech leaves in the woods towards Braunsberg from Oberbieber.

3. *Fridericia lobifera*, Vejd.

This species also was first described by Dr. Vejdovsky (5), and is marked by the presence of large glands attached to the ampulla of the spermathecæ in the place of diverticula. Length up to ¾ inch, with 50–60 segments. The setæ, as in the foregoing cases, number 6 in the front segments and as few as 2 in the tail. The salivary glands branched, dorsal vessel arising about the 20th segment. Brain convex before and behind. Sperm-funnels rather narrow, about three times longer than broad. Schloss Gardens, Neuwied. One specimen had a bifurcated anal extremity.

4. *Fridericia striata*, Levinsen.

First described in 1884 by Levinsen (6), this Worm has been found as far afield as Chili and Uruguay, as well as in Denmark, Switzerland, Germany, and Great Britain. It is stout for its length, and seems to me to be a connecting link between

Fridericia and *Henlea*. My notes agree in most points with the original, and I transcribe them for the light they throw on variation:

Length about 15 mm. when living, but if at rest it may measure no more than 12 mm.; segments 50–60. Transparent and easy to study. Setæ 6 to 8 or 9 in front, 5 and 4 behind, rarely 3. Brain large, convex behind as usual. Salivaries slightly branched. Spermathecæ with short, stout duct, sessile, indefinite glands to the ampulla and two glands at the outer opening. Sperm-funnel not large, say 2–3 times longer than broad, with moderately large long duct and rather large male pore. Large dorsal pores. The dorsal vessel arises about the 18th segment, and the Worm emitted quite an appreciable quantity of white mucus when placed in alcohol.

Habitats: Grounds of the Schloss, Neuwied, and woods around Braunsberg.

5. *Fridericia callosa*, Eisen.

First described by Eisen (7) in 1878 as occurring in Siberia, this Worm has been often found since in various parts of Europe. Like most species of *Fridericia* it is liable to considerable variation. The following are the chief characteristics of the Rhinegau form.

Length about 10 mm.; segments 50. Adult transparent. Setæ 4–6 in front, unequal, decreasing posteriorly to 3 and 2 per set. Dorsal vessel strong, arising about the 20th segment. Three pairs of septals, oval in shape and nearly equal in size. Sperm-funnel small, not greatly exceeding the penial bulb. Duct in the girdle segment long, stout, and much convoluted. The spermathecæ exactly agreed with the type, except that the outer opening is glandular.

One of my specimens was full of encysted Gregarines. Found between Oberbieber and Braunsberg. I have only met with it a few times in England, and in each instance the variations have been considerable.

6. *Fridericia paroniana*, Issel?

An immature specimen of a bisetose species was found among decaying leaves by a streamlet in the woods already mentioned,

which it is impossible to name with certainty, as the spermathecæ were not developed. The available evidence related it more closely to *paroniana* (8) than to any other member of the group. Length of the young Worm 3 mm., segments 30, with yellowish intestine. Setæ 2 per set throughout. Three pairs of septal glands; salivary glands unbranched, extending to the septum 4/5. First nephridium in 6/7, duct arising from the middle of the postseptal portion. Large cœlomic corpuscles. Full of parasites, which rendered the creature fragile, and caused it soon to break up under examination. I find its exact facsimile in Derbyshire.

7. *Mesenchytræus setosus*, Mich.

The genus *Mesenchytræus* was founded by Eisen (7) in 1878. The present species is readily distinguished by the enlarged setæ which occur in segments 5, 6, 7. It is a curious fact that one often finds a larger number of setæ, or setæ of a special type, in this region of the body in close proximity to the spermathecæ. The specimen examined was not adult. Length 6–8 mm., segments 45–50. Nephridia with very small anteseptal and large lobed postseptal. Three pairs of septals, and dorsal vessel arising about the sixteenth segment. Michaelsen records it for Hamburg and Calefeld. Southern has found it in Ireland, and my own records included Oberbieber on the Rhine, Cauldwell near Burton-on-Trent, and Solihull, Warwickshire.

8. *Henlea nasuta*, Eisen.

This is one of the best known and most widely distributed Enchytræids. My specimens, found in the Schloss Gardens, Neuwied, were as follows: Length, 10–12 mm., segments about 60, somewhat short and stumpy. Setæ usually 6, about equal in length. Spermathecæ consisting of a pear-shaped ampulla with a duct somewhat longer than it. Brain a little longer than broad, not widening materially behind, with a concave anterior and incised posterior. Girdle extending over segments 12 and half 13. One pair of œsophageal glands, from the posterior of which the dorsal vessel arises. Cœlomic corpuscles large, broad, oval to round, and well defined.

9. *Chamædrilus chlorophyllus*, Friend.

The last of the white Worms which I have to record is of peculiar interest, because it appears up till the present entirely to have escaped the observation of Continental investigators. It may possibly have been found by Bretscher in Switzerland, but if so his description has not been sufficiently detailed to allow of its identification. I first described it (9) in 1913, but had found it on many occasions previously, without being able to trace its connection with any known species or genus. It is widely distributed in this country, and there was every reason to suppose it would be found on the Continent. Found among beech-leaves by the little brook in the woods between Oberbieber and Braunsberg, the Worm showed the following characters: Length, 6–8 mm., stretching to 10, and very slender; segments 35–40. Setæ, 3 per set, sigmoid. Septal glands five pairs, or four pairs with the hindmost pair lobed so as to present the appearance of being double. Large brown chloragogen cells and large irregular oval cœlomic corpuscles. Intestine yellowish. Brain about as long as broad, incised behind. First nephridia behind the girdle, which occupies an advanced position.

This Worm is closely related to *Bryodrilus* and *Buchholzia*, but differs in many important details alike from the one and the other.

I also found a *Tubifex*, *Stylodrilus*, and various species of *Lumbricidæ*, none of which, however, are related to the Enchytræids.

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NOTES AND QUERIES.

MAMMALIA.

Rats Eating the Eggs of Poultry.—I always thought it was a well-known fact that the eggs of poultry or, in fact, any birds, would be taken by Rats if there were any chance of their getting at them; but from the notices in the 'Zoologist' for last month there seems on the part of some of your correspondents some doubt on the subject. Mr. Butterfield speaks of nests in a wood where there is a stream running —I scarcely like to suggest such an idea, but were all or most of the Rats there Water-Rats or Voles? for I cannot otherwise understand how the nests escaped, if the Rats were ordinary Norway Rats. My experience is that the Norway Rat will take, or break and eat, every egg where it has the opportunity. There is another interesting question on this subject: How does a Rat remove an egg without breaking the shell? They must somehow accomplish this feat, for eggs have often been found in the burrows of Rats, and no hole can be discovered in the shell after the most careful examination. From the great number of poultry eggs I have seen in Rats' holes, I feel sure the Rat does destroy, very largely, all kinds of eggs, not sparing those of the Pheasant and Partridge if the nests are placed on banks of hedge-rows. I have already made this note too long, or I would have given many instances proving the correctness of the statement that Rats do consume eggs when they have the opportunity.—Henry Laver (Colchester).

Rats and Eggs.—Mr. J. Steele Elliott asks whether definite proof can be given of Rats eating eggs. I came across one rather striking instance of this practice. On May 7th, 1907, I was at a small breeding-colony of Black-headed Gulls on a Co. Leitrim lake. The birds were nesting on two little islands. On one of these the nests contained the usual clutches of three eggs, and in a few cases four, but on the other island no nest had more than a single egg. The explanation was there in the shape of piles of empty egg-shells at the entrances to several Rat-holes. The Rats presumably took the eggs daily, or nightly, from every nest. It was in the afternoon that I was on the island. The nests on the other island were very crowded, some even inside a little round cairn.—J. M. McWilliam (Craigmore, Bute).

AVES.

Breeding of the Lesser Redpoll in Sussex.—The breeding of the Lesser Redpoll in Sussex has been so seldom recorded that it is of interest to note that a pair nested this year in our orchard at Battle; I found the nest on May 31st, and on examining it on June 2nd found the contents to be six fresh eggs. The nest was built about 13 ft. or 14 ft. from the ground in a fork at the extremity of a bough, one of those which grew straight upwards from the centre of a small apple tree. The structure was a firm and carefully-rounded cup of dry grasses, bents, and fine twigs, mixed with sheep's wool, vegetable and artificial cottons, and a few feathers; on one side there was a large mass of artificial cotton. The cup was well lined with a mixture of sheep's wool, cotton tufts (perhaps of groundsel), fine grasses, and horse-hairs, the whole forming a soft bed for the eggs. The interior measurements of the nest were 47 mm. in diameter and 27 mm. in depth. The hen-bird sat very closely, only leaving the nest at the near approach of the climber. A second pair of Redpolls were seen a few days later in another near locality.—Hugh Whistler, M.B.O.U. (Battle).

Late Nesting of Barn-Owls.—I have been observing a nest of Barn-Owls this season. Five eggs were laid about the middle of June. Two were addled; the three young birds were still in the nest on September 4th, but were trying to make a hurried exit when I looked in upon them.—Joseph H. Symes (Coat Martock, Somerset).

Scarcity of Corncrakes in Somerset.—In this neighbourhood the Corncrake appears to have become very scarce. I heard one on May 5th and flushed one from a ditch on August 30th, which appeared to be a young bird; it flew a few yards and then went into another ditch. Corncrakes are not so plentiful here as they were in 1912, when I saw two lots of eggs cut out by the mowing-machine in the same field.—Joseph H. Symes.

Common Scoter in Shropshire and Worcestershire.—Whilst walking alongside the River Severn at 6.30 a.m. (G.T.) on September 7th, I saw a Common Scoter (*Œdemia nigra*). When first observed it was quietly sitting in mid-stream, and allowed me to approach on the river bank right opposite to it, and further, did not attempt to fly until I had twice thrown at it, and then passed down-stream right along the quay-side and through the town of Bewdley. When I first

saw it, it was just opposite where the parishes of Dowles and Bewdley adjoin, which is also the boundary of the two counties. It seems strange to find such an uncommon visitor resting on its migration at such an unlikely spot, but a misty morning and the early hour may have accounted for this.—J. Steele Elliott.

Spotted Flycatcher Wintering in Oxfordshire.—Whilst staying in Oxfordshire with the Rector of Waterstock, he informed me that a Spotted Flycatcher (*Muscicapa grisola*) spent the whole of last winter in his garden. He saw it catching flies almost every morning on the sill outside his study window (an upstairs room) throughout the winter.—H. W. Robinson, M.B.O.U., F.Z.S.Scot. (Caton, Lancaster).

Rooks and Railways.—Has anyone noticed that Rooks have a particular fondness for building as near as possible to a railway line? It struck me that I had noticed this when travelling about, and on the last long journey I made, from Tiverton to London, one morning this spring, I took careful note, and saw many groups of Rooks' nests near the line, and only one or two on trees remote from it. Especially noticeable is the rookery at Reading Station; I also noticed Rooks building in one wet wood in trees so low that the nests did not seem higher than the roofs of the carriages. It is a common sight to see Rooks sitting on telegraph-wires at stations, and at Gunnersbury, S.W. London, last year I saw half a dozen foraging on the line. As the train approached Westbourne Park station on the present occasion I saw my last two Rooks on a wire above a wilderness of rails. From my own experience, then, I should say Rooks particularly liked the neighbourhood of the lines; yet there is, I believe, an idea that they do not, but this may be only when a line is newly constructed near a rookery; the numerous colonies one can see on the above journey are surely not all in process of desertion—it looked quite the other way about.—F. Finn.

Status of Lesser Whitethroat and Stonechat in North-West Yorkshire.—A few days ago I happened to meet Mr. Sam Longbottom, of Bingley, who described the song of a bird which he had heard near Saltaire on or about the first week in July last, and I have no doubt but that it was a Lesser Whitethroat. I had heard earlier in the year that this species had been heard in a nursery in the neighbourhood of Saltaire, where it had probably bred; if so, it is a confirmation of my statement (*ante*, page 197) that this species in this neighbourhood does not affect the thickest foliage for

breeding purposes, but the more open country lanes and gardens. It is, however, a rare breeding species in North-West Yorkshire (see 'Zoologist,' 1914, p. 110.)

Mr. Harry B. Booth writes me under date July 17th informing me that Mr. Greaves, of Hebden Bridge, had written him telling him that a friend, Mr. Sutcliffe, reported having seen a pair of Stonechats near Grassington in Wharfedale, and on going to Grassington he had seen a male and female Stonechat and also a young one, strong on the wing, near Grassington railway. Although the pair may have bred somewhere in the neighbourhood where they were observed, it is by no means certain, since it is a well-known habit for some birds, after having done breeding and the young being well on the wing, to wander away from their breeding-haunts. It would have been more satisfactory to have actually found the nest; this would have been a very interesting record. This species is a very rare breeding species in North-West Yorkshire (see 'Zoologist' for 1901, p. 64).—E. P. Butterfield (Wilsden).

Bird and Insect Notes from Bolton Woods, Yorks.—I visited Bolton Woods in Wharfedale on the occasion of the Yorkshire Naturalists' Union visit on Saturday, May 20th last, and stayed the week-end at Hougill under Simon Seat, which is higher up the valley, returning on the following Monday. In the stretch of the river between Bolton Woods and Barden Tower I watched with my field-glasses, for an hour at least, a White Wagtail, expecting to find its nest; but in this I was disappointed, as it kept close to the river, chiefly on the left bank, and in sight all the time, and was busy catching insects. Otherwise I saw nothing else very noteworthy. The usual characteristic birds were there in their usual numbers, viz. Common Sandpiper, Grey Wagtail, and Dipper, of the last of which I saw two nests—one with young and another with eggs. I did not see the Greater Spotted Woodpecker nor the Hawfinch. The head gardener to the Duke of Devonshire informed me that this species had not been quite as common as in some previous years—a remark quite as applicable to this district (Airedale). It is, however, interesting to again record the nesting of the Woodcock in Bolton Woods. The Green Hairstreak Butterfly (*Thecla rubi*) was quite common, nay, it can be said to have actually swarmed, in the haunts where my brother and I found it thirty years ago, and the somewhat local Bee *Andrena cineraria* had its nests in abundance in some drift mounds near Hougill.—E. P. Butterfield.

ARACHNIDA.

Same Species of Tick Infesting Polecat and Otter.—In an article in 'The Field' of July 29th, 1916, on the Polecat by Miss Frances Pitt, I was interested to read that the tick found upon these animals was the species *Ixodes hexagonus*, for curiously enough the same species is sometimes found upon the Otter. On August 6th, 1910, I took females of this species from the head of a dog Otter killed by hounds near Lancaster, and although I have handled a fair number of freshly-killed Otters at different times, this is the only one upon which I noticed any parasites. As I am informed by Miss Pitt that all the ticks found upon the Polecats were females, the same being the case with all those taken from the Otter, it would be interesting to learn where the males of this particular species are to be found.—H. W. Robinson, M.B.O.U., F.Z.S.Scot. (Caton, Lancaster).

ECHINOIDEA.

A Mode of Feeding in a Sea-Urchin.—On p. 98 of the present volume of 'The Zoologist' it was pointed out that a captive Purple-tipped Sea-Urchin had been observed to wrap a long *Sabella* around its body in such a way that the echinoderm was able to feed easily upon its inconveniently long victim. During a vacation dredging expedition at Walton-on-the-Naze (Essex) on June 29th I obtained a number of fine examples of this species of Sea-Urchin. One of these animals, which was about 40 mm. in diameter (including the spines), carried a *Sabella* wrapped tightly around its body. The worm lay at right angles to the equator of the echinoderm, and one end of the tube of the *Sabella* was found actually within the grasp of the Sea-Urchin's teeth when the echinoid was lifted out of the dredge. This observation upon a free Sea-Urchin affords welcome confirmation of those previously made only upon captive individuals.—H. N. Milligan.

Rate of Growth of Echinus miliaris.—A Purple-tipped Sea-Urchin (*Echinus miliaris*) lived for 436 days in an aquarium. When the animal was captured its long diameter (excluding the spines) was 27 mm., and at the time of its death this diameter had increased to 30 mm. The growth in diameter of the Sea-Urchin had therefore been at the rate of 1 mm. in every 145·3 days. Of course, the rate of growth of a marine animal in captivity may be quite different from that of the same animal in the sea, but so little is known upon the subject that any facts which bear upon it will be useful.—H. N. Milligan.

NOTICES OF NEW BOOKS.

The Birds of Britain, their Distribution and Habits. By A. H. EVANS, M.A., F.Z.S., M.B.O.U. Cambridge: University Press. 1916. 4*s*. net.

Mr. EVANS's contribution to the already enormous series of British bird books is of a handy size and attractively got up; it is also plainly written as a whole, with but few technicalities and no evolutionary or sentimental padding. An introductory chapter gives some information about the class as a whole, and is followed by a list of the orders and families, while, after the general body of British birds has been treated of, a nominal list at the end is devoted to occasional visitors.

The book is designed for the use of schools, and for beginners generally; and it would have been better, in view of this, if a little more attention had been given to the descriptions, which are often very insufficient. Not only are the characters given often those of but one style of plumage when the species exhibits, according to age or season, more than one, but indications of size are rarely given, and these, we know from much teaching experience, are particularly needed by learners. The description of the Raven as a "fine glossy black bird" does not differentiate it from the Carrion Crow, and the description of the female Eider as "plain brown and buff" would suit half-a-dozen of our Ducks of that sex. Sometimes there are positive mistakes, as where the young Starling is credited with showing yellow on the bill, and the Mallard with a marked sexual difference in the colouring of the speculum, said to be purple with a white border in the drake and green in the duck. The illustrations, mostly from photographs, are numerous, but not always clear or well selected; it would have been better, we think, to have figured the Razor-bill rather than the Great Auk, and the Sparrow-Hawk than the Greenland Falcon. Here also there are two grave errors: the illustration purporting to show the Spotted Flycatcher represents the Pied species, and is upside down, and the bird figured as the Common Crane represents, not that bird, but a pied hybrid between the Canadian and Manchurian Cranes which shares the Common Cranes' paddock at the Zoo, where the photo was taken. The distribution of birds outside Britain is not always correctly given, the winter range being sometimes ignored, while it is even misleadingly represented in the case of the Wigeon, said to visit in winter "North America and other countries," this bird being, as a matter of fact, only a straggler in the New World.

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THE ZOOLOGIST

No. 905.—November 15th, 1916.

ON THE SEXUAL ORIGIN OF THE NIDIFICATORY, INCUBATORY, AND COURTING DISPLAY INSTINCTS IN BIRDS: AN ANSWER TO CRITICISM.

By Edmund Selous.

The 'Zoologist' for June of last year contains a contribution —viz. "Notes on the Courtship of the Lapwing"—by Miss Maud D. Haviland, which I did not read till a long time after it had appeared. In it the writer comments, forgetfully, on some observations made by myself on these same activities, which were also published in the 'Zoologist' fifteen (not "ten") years before the above-mentioned date, and also criticises certain suggestions made by me in explanation of actions the true nature of which had not been, up till then, and is not, I think, now fully realised, but which of itself, as it were, and automatically, throws new, or rather, perhaps, the first light on the origin of courting display in birds. This part of the subject, however, I must perforce neglect, owing to the small space at my disposal. What I shall have to say will relate principally to the first, and, in a fair degree, also, to the second, of the three instincts specified in the title. On p. 220 of the paper referred to Miss Haviland thus comments on my note on the "rolling," as I have called it, of the female, as well as the male Peewit:—"If his discrimination" (of the sexes) "is correct (and Mr. Selous will pardon any implied doubt) his record is of much interest.' I can resolve all reasonable doubt, as follows: My attention

was confined to two birds, and two only, nor were there any others in their immediate neighbourhood. Therefore, if I saw them both roll—which I did—then both the male and female rolled, if the two were male and female. But the two had just paired: therefore they were male and female. One of them rolled first. Almost certainly this one was the male, but, to quote my conscientious text:—"I am not quick enough with the glasses to be quite certain." The other (and it was certainly the other) then rolled also in the less pronounced manner which I have described.* The doubt then is not whether the female rolled, but whether she rolled more or less vigorously than the male in this instance. Discrimination is a great matter—but so is context. In the same conclusive way I have shown† that the female Peewit not only, on occasion, rolls, but that she also goes through the same specialised pecking or picking-up actions as the male. Essentially, therefore, all of what the male does, as a result of which we have a circular depression with grass-stems laid on it‡—a nest, in short, in structure, if not in function—the female does also, in kind if not in degree, and moreover (this is the specially important point in my observations) the two birds act thus, in partnership, under a common stimulus which either *is* the pairing, or includes that in its effects, and is therefore certainly sexual. It is, therefore, a legitimate conclusion that the nest itself has arisen out of these actions, common to both the sexes. Miss Haviland is mistaken in supposing—as she appears to suppose§—that I attribute the part played by the hen to imitation merely. To argue on an assumption is not to accept the assumption.

I shall show later that bi-sexual action, of the "antic" kind, in birds is not so infrequent as Miss Haviland is under the impression that it is,‖ and that in saying that I do not give any other examples of it than that of the Peewit,¶ she is—unless this refers only to my paper specially on that bird—much

* See (for full confirmation of above) 'Zoologist,' April, 1902, pp. 136, 137; also 'Bird Life Gleanings,' pp. 164, 165.

† 'Zoologist,' pp. 136–7.

‡ See *post*, p. 406.

§ 'Zoologist,' pp. 224–5.

‖ *Ibid.*, p. 223.

¶ *Ibid.*, pp. 223–4.

mistaken.* The fact that, speaking generally, such action is more developed in the male does not, in my opinion, tell against my view, for when Miss Haviland says :—"It is not likely that the necessity for amatory exercises, as a way for working off emotions, should have lapsed in one sex and not in the other, especially when the resultant passion to make a nest has persisted so strongly,"† I am quite unable to follow her. I think it is what, *primâ facie*, one might have expected, on the principle of specialisation and division of labour as brought about through natural selection, which would have preserved the "resultant passion," because useful, whilst letting the steps that had led to it lapse because, being no longer so, they now represented waste energy or energy in excess of the bird's capacity. Some check on expenditure there must be, and Nature's retrenchments would be upon the same lines as our own.

And what is meant here by "necessity"? Things are only necessary, in evolution, till replaced by other things more necessary—*i. e.* more beneficial—*pro tem.* Marvellous instances of this lie before us. The female instincts and organs must once, in every case, have been necessary for the female ant, but they have gone, to make her the worker ant. How much more easily then, might anticking female birds have been turned into non- or less anticking nest-building ones. Also the "amatory exercises," assumed by Miss Haviland to be necessary, may not even be of importance. They may be—and very likely are—no more than a by-product, which, as long as it were not detrimental, might continue indefinitely, offering good raw material for natural selection to seize on and make something useful out of. Many of the fine things of higher human nature—romantic love, for example—are but by-products in respect of Nature's main scheme of advance, but, being compatible with it, they go on, and we go on thinking too much of them.

Miss Haviland does not think that the cock bird often helps the hen in nest-building, and her opinion, in regard to exceptional facts, appears to be that they mean nothing and point nowhere.‡

* See *post*, pp. 406 (3), 407 (6) (10), 408 (14). I can, however, owing to the exigencies of space, only give marginal references to this and other facts essential to my argument, and supporting the statements in the text.

† 'Zoologist,' p. 223.

‡ *Ibid.*, p. 225.

This to me seems grotesque. The significance of a fact does not lie only in its frequency, and Darwin himself would have been very much hampered in his reasoning could he have drawn no conclusion from cases of survival, reversion, or other anomaly, till they had been proved to outnumber those in which no such departure occurred. But, in the first place, there is another class of assistance, besides that of nest-building, which the male bird may render the female—incubation namely—and, in so far as my theory (with which Miss Haviland does not appear to have made herself entirely acquainted) is concerned, the one kind is as pertinent to the argument as the other, since I suppose that there was, first of all, the pairing-place, merely, which became the nest by reason of the eggs being laid there and incubated owing to their having been laid there—all this independently of whether structure, even of the most primitive kind, had yet supervened. Why, indeed, should the male bird help to incubate eggs, not his own, any more than he should help to make a nest for those eggs? In my view, both these effects, as well as that of true courting display action, grew out of the same ultimate cause, viz., the sexual spur.* They are, in this connection, parts of one whole, and therefore, for me, the inferences to be drawn from the co-operation of the male, in either of these two functions, are alike. It is, of course open to Miss Haviland to show the fallacy of my inferences either in the one or the other case, or both, but she must not rob me of half my material, whilst running away from the other half, on the ground of its being exceptional—as to which let us see.

What, then is the proportion of species in which the male bird helps the female, either in building the nest or in incubating the eggs, to those in which he shares in neither? Here to some extent is the answer. Out of 212 species of birds that are mentioned in 'The British Bird Book' as breeding, either habitually or occasionally, in these Islands, the details on this head, given in the "Classified Notes," are as follows: In 63 species out of the whole 212, the male bird assists the female both in nidification and incubation. In 13 species he assists her in nidification, but whether he does in incubation also is

* Incubation, however, more incidentally and less genetically than the other two. See *post*, p. 408 (11) and (12) with marginal references.

uncertain. In 9 species he assists her in nidification, but not in incubation. In 56 species he takes part in incubation, but it is uncertain whether he does so also in nidification; and in 43 species he helps to incubate only. In 28 species the male is stated neither to build nor to incubate, and as 22 of these belong to either the Duck or Pheasant families, whilst the Ruff and Great Bustard are included in the other 6—all great displayers—we can understand this on the principles already adverted to. Also, through the law of reversion, but not very easily otherwise, we can understand why the male Pheasant (as the best known) has sometimes been known to incubate.

There are thus left 39 species where the participation of the male either in one way or the other, is doubtful, but as more than half of these are more or less rare birds, and the greater number of shy, retiring, or nocturnal habits, it is obvious that a fair proportion of them (since there is not the precedent reason against it) will in time be added to the affirmative list.

Let us, however, take certainties only, or what, within a moderate margin, may be assumed to be such. There are 173 species in which the part played by both sexes, in the matters under consideration, is given as ascertained, and in 145 of these the male assists the female either in incubation or nidification, or both. That is a proportion of more than five-sixths. Where the assistance is in nidification only, the number given is 85—practically half—and where it is confined to incubation, 123, which is nearly three-quarters. The supposed exceptions, therefore, outnumber the supposed rule. How is this to be accounted for? Have large numbers of male birds acquired certain domestic habits which did not originally and naturally belong to them, but only to the female? Or were such habits—once common to both the sexes—lost by many males, in the course of evolution, owing, as we may surmise, to the advantages derived from division of labour, differentiation, and the economy of force—Malpertuis' law of "least action?" If the instincts which give rise to these habits have, as I hold, been evolved out of the primary sexual one, then, as this came first and is universal, the second of these suggested explanations would seem to be the more probable. What is the direct evidence? I have, at various times, observed and recorded certain facts in the nuptial

and domestic life of birds, which, with some others that I have on authority, seem to me to point to the conclusion that the said instincts, as set forth in the title of this paper, have been so evolved. These facts may be summarised under the following headings (where not otherwise indicated, the references are to my own observations):

(1) The picking up and letting fall again, or placing in such a spot as is commonly chosen for the nest, of materials used in making the nest, by the male bird, together with other more or less marked actions, or as part of a general behaviour, due to sexual excitement; this either in the presence or absence of the female, during the earlier part of the breeding season, before the actual nest has been begun or even the actual mating settled.*

(2) The further fact that as a result of such sexual actions as a whole, or of some of them, something more or less closely resembling the nest of the species is actually made by the male bird.†

(3) The participation of the female in these and other sexual actions and movements of the male, inclusive of the true courting display, into which they gradually pass.‡

* 'Bird Watching,' pp. 71–2. 'Zoologist,' April, 1902, pp. 135–7, 142–3. 'The British Warblers,' H. E. Howard, vol. i, 2, pp. 6–7, with plate facing p. 6; 4, p. 9, with plate facing p. 9; 5, p. 10: vol. ii, 23, p. 8, with plates facing pp. 10 and 12; 25, pp. 13, 14, with plate facing p. 11; 26, p. 5, with plate facing p. 4; 20, p. 41.

† 'Zoologist,' April, 1902, pp. 138–9. "Birds of the Breck," W. Farren, and "The Woodlark in East Berks," E. E. Pettitt, in 'Wild Life,' June, 1915, pp. 164, 170. As more recently observed by me, the circular depression in the ground made by the male Peewit is sometimes lined.

‡ 'Zoologist,' April, 1902, pp. 136–7; May, 1902, pp. 196–7; September, 1901, pp. 343–4; May, 1907, pp. 168, 169; May, 1912, pp. 179–80; June, 1912, p. 213; February, 1914, pp. 63, 66. 'Wild Life,' March, 1914, p. 143; April, 1914, pp. 206–7, 209–11; May, 1915, pp. 151–2; February, 1916, pp. 51, 53–4. 'Bird Watching,' pp. 18–20, 42–3. 'Bird Life Gleanings,' pp. 164–6, 288, 'The Bird Watcher in the Shetlands,' pp. 125–31. 'The British Warblers' (H. E. Howard), vol. i, 5, pp. 8, 10, with plate facing p. 10; 12, pp. 17, 18, with plate facing p. 30; 14, p. 17, with plate facing p. 16; 15, pp. 13, 14, with plate facing p. 12: vol. ii, 21, pp. 35–6, with plates facing pp. 32, 34; 25, plate facing p. 18; 26, p. 5, with plate facing p. 6. The 'Scottish Naturalist' ("The Display of the Mallard," S. E. Brock), April, 1914, pp. 79–80. The list includes 23 species, representative of 8 orders, 5 sub-orders, and 14 families.

(4) The actual building by the male bird, before the arrival from overseas of the female, and in a state of sexual excitement, of a nest, which, upon her arrival, she helps to finish, and in which the eggs are then laid and incubated.*

(5) The building by the male, after the arrival of the female, of one or more nests, previous to the participation of the latter in the work, when, by the joint efforts of both, a final one is made in which the eggs are deposited.†

(6) Actions of the female bird in nest-building, curiously resembling some sexual actions of the male of another and widely separated species, as a consequence of which similar actions, an essentially similar result, in the case of the real and the so-called "false" or "mock-nest," is produced.‡

(7) Coition on the nest, either (apparently) invariable, or more or less habitual, in the case of various species of birds, representing (as observed by myself) three orders.§

(8) The catching up by the female of some part of the material of the nest thus used as a pairing-place, either during or immediately after coition, whilst—in the first case certainly, in the second inferentially—in a state of sexual excitement.

(9) Actions, similar to the above, of the female, whilst sitting alone, on the nest thus used, awaiting or pending the return of the male, to repeat the act of coition.¶

(10) The apparent association, in the mind of both the male and female bird, of nidification and coition, as shown by (*a*) the former activity either immediately preceding or succeeding or even traversing, and, to some extent, impeding the latter; and (*b*) the act of taking up in the bill such material as is used in making the nest, even when the birds thus acting are at a distance from and out of sight of it, having become, with them, a symbol of conjugal union on the nest, as shown by its being

* 'The British Warblers,' H. E. Howard, vol. i, 1, p. 8, with plate facing p. 13.

† 'The British Warblers,' vol. i, 1, pp. 11–13.

‡ 'Zoologist,' April, 1902, pp. 140–1.

§ 'Zoologist,' May, 1901, pp. 162, 181; September, 1901, pp. 341, 345; June, 1914, pp. 224–5. 'Wild Life,' April, 1914, pp. 211–12; June, 1915, pp. 177–8; July, 1915, pp. 31, 34; August, 1915, pp. 41–2.

‖ 'Zoologist,' June, 1914, p. 216; 'Wild Life,' June, 1915, p. 178.

¶ 'Wild Life,' April, 1914, p. 212.

immediately, and with a special impetus, followed by a resort to the nest, for that purpose.*

(11) The lengthy sojourn of the female on the nest, during which, visits are made by the male for the purpose of coition upon it, this taking place either (*a*) before any of the eggs have been laid, as observed, or (*b*) after one or more of them have been laid, as inferred from the conduct of the birds, in preparation for this act; these facts suggesting possible stages through which the earlier use of the nest, as a pairing-place, has passed into the later one, and incubation, owing to the presence of both parents, in contiguity with the eggs, become common to both, a fact which, seeing that they are only laid by one of them, one would not, *prima facie* expect to find in any case.†

(12) The habitual daily presence, during considerable periods of time, of both the male and female bird, on a certain spot where pairing takes place, and where the nest is subsequently gradually built, with continuance of such pairing upon it, thus greatly strengthening the above surmise.‡

(13) Reversed functioning as between the sexes, *in coitu*, suggesting the essential oneness, in both, of the sexual feelings from, or in connection with which, all sexual movements, antics, etc., must have originated; which makes it easier to suppose that any transforming process of evolution in such movements, in any direction, has been essentially the same in both, as also that any of them may have passed from one sex to the other, with consequent increase, decrease, or cessation of the activities thus transferred, in either, according to the ordinary law of the utilisation of beneficial variations, through natural selection.§

(14) The recurrence of sexual actions and movements, including those of true courting display, such as ordinarily precede coition, immediately after this has taken place, on the

* 'Zoologist,' September, 1901, pp. 343–4; June, 1914, pp. 213–14. 'Wild Life,' June, 1915, p. 178; July, 1915, pp. 32–4; August, 1915, pp. 38–9, 41–2.

† 'Zoologist,' May, 1901, pp. 162–5; 'Wild Life,' April, 1914, p. 212.

‡ 'Wild Life,' May, 1915, p. 153; June, 1915, pp. 177–8. The facts are brought out more fully in my actual notes (unpublished), of which the paper is a *résumé*.

§ 'Zoologist,' September, 1901, pp. 341–2; May, 1902, pp. 196–7; May, 1907, pp. 168–9. 'Wild Life,' July, 1915, pp. 31–5; August, 1915, pp. 38–42.

part not only of the male, but, in some cases, of the female also, suggesting an association of ideas, in the minds of both, as between this act and the actions and movements in question, through some of which latter, as has been seen, the so-called "false" or "mock nest" of the male is produced. The question also arises whether the nidificatory activities, as well as the courting display actions of birds, may not have originated in such actions as these, thus occurring, whatever the reason, as after-effects of the act of coition.*

The suggestiveness of the above facts—the great mass of which stand in an actual and not merely an implied relation to (*a*) the construction of the nest, and (*b*) a certain earlier use of it than the widely different one, to which it is commonly put—is sufficiently obvious. They lie on the threshold of any inquiry into the origin of the nest-building instinct in birds. They cannot be ignored, they have to be accounted for. My theory accounts for them, binds them, as it were, together, and makes an understandable whole of them. Therefore it is incumbent on any alternative theory to explain them better, in some other way. That cannot be said to be done by the one put forward by Miss Haviland, viz., that the nest has arisen owing to the desire of the hen bird to shield her eggs from wet or damp,† for it does not explain them at all; and that, I think, is a sufficiently destructive criticism, since it is the function of a true hypothesis to explain all facts that are relevant to the issue, and facts which have a strong appearance of being relevant to the issue—as those I have adduced most certainly have—must be deemed to be so until they are shown not to be. Independently, however, of this objection, the view here advanced is, I believe, untenable, for the three following reasons: (1) Because the drastic methods of nature must, far more efficiently and in a far shorter time, have brought about the kind of protection required, through the constant remorseless weeding out of every individual bird or egg not strong enough to live and thrive under the ordinary conditions of its environment (which, by the way, include tepid

* 'Zoologist,' April, 1902, pp. 136–9; May, 1902, pp. 196–7; June, 1906, pp. 201–4, 209–10, 212. The 'Scottish Naturalist' ("The Display of the Mallard," S. E. Brock), p. 80.

† 'Zoologist,' p. 244.

water in the case of an incubating Grebe's eggs):* (2) because the demand here made upon avine intelligence is altogether too great: and (3) because the supposed effects, on a general review, are not in harmony with the supposed cause. I may here point out that if a bird only modifies, however intelligently, the existing structure of a nest, however rude, it does not thus originate such structure. To do that, it must, for the first time, make use of a stick, stalk, stone, etc. Of course, when structure had once begun, beneficial variations in it, from whatever cause arising, would be taken advantage of by natural selection without prejudice to my theory which is only concerned with how it did begin.

Miss Haviland finds no difficulty in believing that the bird's nest was an outcome of bird intelligence. To achieve doubt, she should compare the nests and nesting habits of various species, for contradictions and irrelevancies would then swiftly accumulate. But, in place of reasoning, we have confession of faith, and no evidence is given; for the case of the Dunlin that, when her nesting hollow was flooded during the night, "collected a rim of bents a quarter of an inch high" (which is not very high) "round her breast"† is, as it stands, none. Where are the details? Were the bird's actions, "during the night," observed? A flood must, almost certainly, involve some motion of the water, even if slight, in one direction rather than another, so that some of these bents, if not all, might easily have floated against the bird's breast, the very fact of which might well have brought its instinctive activities into play. The facts, as given, establish nothing, but upon them we have the usual question-begging comment: "She did not grasp the necessity of raising the eggs themselves out of the wet, and, consequently, both she and they were still lying in the water, but, in her futile attempts to protect them and herself from the damp ground, do we not see, etc."? ‡ In short the bird *did* nothing effective, and Miss Haviland *assumes* that she meant to.

* That the shell is the natural shield of the egg seems to have been quite overlooked by Miss Haviland.

† 'Zoologist,' p. 224.

‡ *Ibid.*, p. 224.

Those acts without result, merely, must be proved to have been attempts to produce the result supposed to have been intelligently wished for, before we are justified in seeing anything that might follow from this. The particular instance, therefore, breaks down, and, beyond it, there is only a form of general assurance which is no more than phraseology. "It is well known," says Miss Haviland, "that all nests undergo considerable repairs and structural alterations, when circumstances require it."* This sounds very human, but my own observations have assured me that these so-called repairs are often undergone when circumstances do *not* require it, nor have I ever seen any act of the kind to which such terms seemed strictly applicable, or that could not be more probably explained as due to routine and the strength of the nidificatory instinct.

I quite agree that the idea that this instinct has originated in and grown out of the uncouth violence of what I have called the sexual frenzy, in birds, seems, at first sight, "in the highest degree fantastic," as Miss Haviland pronounces it to be. But the facts, also, which I have adduced in support of my views, may seem to offend in this way. My apology for them is that they exist, and, for my hypothesis, that it explains them, and therefore till another is forthcoming which explains them better (to do which it must first take note of them) it is entitled, fantastic-seeming or not, to rank as a provisional one.

Space only allows me to allude briefly to one or two other points. Miss Haviland says that the conduct of the birds under her observation differed in several particulars from what I have described.† I cannot, for my own part, find any essential difference in fact between our two records, but there is a good deal in interpretation of fact, which is perhaps what is meant. Miss Haviland, for instance, thinks that one part of the uncouth spring-tide actions of the male Peewit constitutes a genuine courting display. I, however, have not seen sufficient evidence that this is the case, nor do I find it in Miss Haviland's notes.‡ Checking these with my own,§ I believe that a wrong conclusion

* 'Zoologist,' p. 224.

† *Ibid.*, p. 217.

‡ *Ibid.*, p. 219 (*d*).

§ *Ibid.*, April, 1902, pp. 136–7.

has been drawn from the premises. There is a test in this matter. True courting display action should, in the early spring, be the habitual causal prelude to pairing, but I have never once seen it so with the Peewit, nor does Miss Haviland state that she has. Miss Haviland writes as though she thought I considered these movements, *in toto*, to be ordinary display actions, whereas I was the first, I believe, to point out their true character. That was some sixteen years ago now, yet Miss Haviland, so far as I know, is the first endorser or partial endorser of the fact, which, however, by presenting us with a sequence, seems almost to show us the origin of courtship in birds. Again, Miss Haviland is inclined to think that Peewits have special places for their "amatory exercises," and says that if there were no distinction between these and their breeding haunts "this would afford considerable corroborative evidence for some of Mr. Selous' conclusions."* I can certainly claim this corroborative evidence. The birds lay and "roll" over the same areas, and I have found the real nest, with eggs in it, at but a few paces from the "false" one, caused by the rolling of the male on that spot, as also witnessed by me.

Miss Haviland touches also upon another point of difference in our respective records, on which I might say something if I understood it better; but I am not sufficiently a grammarian. I know nothing about "the dogmatic tense," and the dogmatic mood (which might seem more germane to the matter) is not mine.

* 'Zoologist,' p. 222.

NOTES ON BIRDS SEEN DURING THE GALLIPOLI CAMPAIGN.

By D. A. J. Buxton.

I had been intending to write a longer paper on the birds seen during the Gallipoli campaign, but Captain Boyd's paper* covers nearly all my ground and a great deal more besides. So I will only add the few notes following.

Common Wheatear (*Saxicola œnanthe*).—A nest in a ruined farm on the West Krithia Road, on May 18th. The numbers of this species seemed greatly increased at Suvla and on Imbros in September, but very few, if any, stayed till the middle of October.

Redbreast (*Erithacus rubecula*).—One seen on October 13th and one a day or two later, at Suvla, in the oak-scrub. They were very shy compared with English Robins.

Sardinian Warbler (*Sylvia melanocephala*).—This bird was common in the oak scrub round the Gully all the summer, and at Suvla in September and October. Specially large numbers were present towards the end of October.

Yellow-browed Warbler (*Phylloscopus superciliosus*).—I am almost certain I identified this species in some walnuts near Morto Bay on May 2nd and in the scrub at Suvla on October 21st. On the latter date *Phylloscopi* of several species were very abundant.

Great Tit (*Parus major*).—Seen in the same walnuts as the *Phylloscopi* in May; not again till October 10th, at Suvla, in a

* 'Zoologist,' vol. xx, April, 1916, p. 121.

large Turkey oak in the plain. Some of their notes struck me as unfamiliar, and their plumage as unusually bright, and tails as rather short.

Blue Tit (*Parus cæruleus*).—Several brightly-coloured specimens were in the oak scrub at Suvla about October 20th.

Great Grey Shrike (*Lanius excubitor*).— Seen on May 12th on a thorn-bush on the West Krithia Road. *L. minor* and *L. collurio* arrived about that date. Immature specimens of the latter were common at Suvla at the end of August and throughout September. I saw one catch a large Hawk-Moth (probably *Chærocampa euphorbiæ*) at dusk on the wing and devour it in a tree near by.

Spotted Flycatcher (*Muscicapa grisola*).—Seen on May 5th at Helles; not again till September, when they were common about the camps on Suvla Plain, taking up their post at any point where flies were particularly bad.

Swallow (*Hirundo rustica*).—First seen at Mudros, in Lemnos, on April 18th, going north in numbers. Again, on May 11th and 12th, flying up the Aegean coast of Gallipoli (*i. e.* north-east) in a continuous stream all day. Ditto May 15th, 17th, 19th. This date seemed very late for northward migration still to be in progress. The only place where the Swallows seemed to nest was Sedd-ul-bahr (May 31st). Earlier in August they became commoner again, and were still inclined to travel north-east. Indeed, there never appeared to be any returning stream of migrants, at any rate before I came away, near the end of October.

Sand-Martin (*Cotile riparia*).—One appeared on May 1st and a few more on May 19th; not seen again.

Black-headed Bunting (*Emberiza melanocephala*).—Small flocks (ten to twenty in number) of both sexes of these birds seemed to arrive May 6th–8th, frequenting the tracks and open ground. They soon paired off, and were then less conspicuous, particularly the females. The note of the male was often to be heard early in the summer, but they grew gradually scarcer, and I never saw or heard one after August 1st in the Gully.

Calandra Lark (*Melanocorypha calandra*).—My only definite record of this species is of a pair seen near "W" Beach on April 30th.

Desert Lark (*Ammomanes* sp.)—I record this bird with much hesitation, as neither *A. deserti* nor *A. cinctura* seem to have been recorded from the neighbourhood of the Dardanelles. But, comparing the description I took down at the time with specimens of *Ammomanes*, I am quite clear in my own mind that it was this bird that I saw several times on sandy ground sparsely covered with shrub near the West Krithia Road on May 8th. It was very conspicuous, singing and hovering at no great height. I noticed that the primaries and tail were considerably darker than the rest of the plumage, but whether it was *A. deserti* or *A. cinctura* I cannot say: both species have a wide range in North Africa and Asia.

Raven (*Corvus corax*).—Very common on Imbros in September. A few at Suvla in October.

Swift (*Cypselus apus*).—Thirty or forty passed up the Gully (*i. e.* north-east) on June 1st; one on June 24th, and on August 9th.

Greater Spotted Woodpecker (*Dryobates major*).—The specimen that I saw in some tall elms in the middle of our ground at Helles on May 2nd and 18th was certainly this species, and not *D. lilfordi*.

Common Bee-eater (*Merops apiaster*).—A pair on the West Krithia Road on May 15th and 18th.

Hoopoe (*Upupa epops*).—Like Captain Boyd, I did not see this bird till August, in the Gully. I saw it again at Suvla in August, and on the hills of Imbros in September.

Great Spotted Cuckoo (*Coccystes glandarius*).—A pair on the West Krithia Road on May 8th and May 24th.

Red-legged Falcon (*Falco vespertinus*).—A pair quarrelling with a family of Kestrels in a Turkey oak on Suvla Plain in September.

Cormorant (*Phalacrocorax carbo*).—Mudros, April. One seen in the mouth of the Dardanelles during the landing on April 25th.

Turtle-Dove (*Turtur communis*).—On May 5th I saw a flock of twenty or thirty roosting together, but they must have paired soon afterwards. On July 15th I found a nest in a small thorn-bush, four feet up, containing a newly-hatched bird, dead. Another dead one was found the same day, just fledged.

Common Crane (*Grus communis*)?—Large flocks of what I

took to be these birds migrated southwards over us at Suvla in October. They first appeared on October 13th and 14th, flying in huge flocks and very high, though their loud clanging note, which seemed as if it might be uttered in surprise on seeing Gallipoli so transformed, was very distinctly audible. They flew in a rough V-shaped formation, and usually came over us in the morning or evening. They were freely fired at, but I only heard of one being brought down, and that was at Anzac. Some more passed on October 20th and 21st, in smaller flocks, twenty to a hundred birds in each. I find that Captain Boyd took them all as Storks (*Ciconia alba*), and definitely identified some as such, though many flew too high to be identified, or came over at dusk. Referring to various books, I find that both species might have been migrating about that time, but cannot find any definite dates. The size of the flocks and their note make me still inclined to think that many were Cranes. It would be interesting if any one could give us any further information from previous experience or from birds brought down on Gallipoli, and so clear the matter up.

THE STATUS OF THE BLACK REDSTART IN ENGLAND AS A BREEDING SPECIES.

By the Rev. F. C. R. Jourdain, M.A., M.B.O.U.

It is one of the many remarkable facts connected with migration, that though the breeding grounds of the Black Redstart (*Phœnicurus ochrurus gibraltariensis*) lie for the most part to the south of the British Isles, yet this species winters in fair numbers along our southern coast and the adjacent counties, and occurs on the spring passage every year in March and April, sometimes even in May. As it breeds freely on the other side of the Channel, it would not be very surprising to find it nesting in our south-eastern counties, but hitherto all the evidence of this has been extremely unsatisfactory.

Let us consider the supposed cases of breeding in chronological order.

The first statement to this affect was made by J. C. Bellamy, the author of the 'Natural History of South Devon' (1839), who asserted that it had been known to breed at Exeter. No further details are given, and the record was obviously not given on his own authority, so that in default of confirmation in more recent times, it may be passed over as far too vague to be accepted.

The next occurrence is, however, more definite.

John Hancock, in his 'Catalogue of the Birds of Northumberland and Durham,' (1874), after describing this species as an "extremely rare" Spring and Autumn migrant, states that a

pair nested in a garden in the city of Durham in 1845, and that the nest and one of the eggs passed into his possession. Nothing is said here as to whether the eggs were authenticated in any way, but the late Canon Tristram, writing sixty years after the event, gives some additional particulars. The nest is said to have been built 'on a cherry tree trained on a wall'—an unusual site for a bird which nests in holes; and the birds are also stated to have been shot: the male being in the Durham Museum. ('Victoria History of the County of Durham,' I, p. 178.) If these additional particulars, written after so long an interval, can be trusted, and the male in the Durham Museum can be traced and shown to be the bird in question, this case may be said to be substantiated. It is curious, however that no mention is made of it by Professor Newton in the fourth edition of 'Yarrell,' as it certainly seems to have rather better claims to recognition than any of the others. It must, however, be remembered that Durham is considerably further north than any known breeding place of this species, and that its occurrences as a passage migrant are extremely few. Mr. A. G. More ('Ibis,' 1865, p. 22) says that Mr. J. Tracy includes it in his list as having nested in Pembrokeshire, but on referring to Mr. Tracy's paper ('Zoologist' 1850, p. 2641) I find it recorded as a 'very rare' autumn visitor, of which two occurrences only are noted.

On May 8th, 1852, two boys, while birds-nesting at Longdon,* near Rugeley, Staffs., found a nest in a heap of thorns lying near a hedge, containing four white eggs, which they took to Mr. R. W. Hawkins In this case the parents were not identified in any way, but from the appearance of the eggs, Mr. Hawkins came to the conclusion that they were probably Black Redstart's. He does not, however, assert this positively, but says "If not the eggs of the Black Redstart, what are they?" The nest and an egg were subsequently sent by Mr. Hawkins to the Rev. F. O. Morris, and were actually figured by him in his 'Natural History of the Nest and Eggs of British Birds,' Part 26 (p. 53) as the eggs of the Black Redstart! To anyone familiar with the nesting-habits of this species the site described would alone be enough

* Misprinted as 'Rongdon' in the 'Zool.' 1852, p. 3503: and also in the fourth edition of 'Yarrell' I, p. 334 and the 'Ibis.' 1865, p. 21. This shows the necessity of correcting misprints in order to avoid repetition of error.

to discredit the supposition. Possibly the eggs were the very rare white variety of the Hedge-sparrow's egg: the site would be a very likely one for this species. In any case there is nothing to connect them with the Black Redstart, except a statement subsequently made by Hawkins to William Hewitson that "a respectable person in his neighbourhood" had seen a pair of birds the male of which he described as resembling a Black Redstart, nesting in a wall, and that the eggs were white (Col. Illustr. Vol. 1. p. 106).

An even more extraordinary statement was made by W. J. Sterland, in his little book on the 'Birds of Sherwood Forest' (p. 67), who believed that he had found this species on three occasions in Nottinghamshire nesting in hedgerows! and who took in May 1854 four white eggs, one of which afterwards was passed into Professor Newton's collection. In the 'Ootheca Wolleyana' I. p, 308. the professor stated his belief that these eggs were really those of the Blackcap. From the position of the nest it is impossible that Sterland could have had a good view of the bird, and his description of the nests would pass for those of the Blackcap. Of this record we may say in Seebohm's words that "the position of the nest in a hedge almost amounts to proof that he was mistaken in his identification."

In 1858 Mr. G. Kirkpatrick found a nest with five white eggs on a patch of waste moor at Duncow, near Dumfries. The nest is said to have been like a Yellow-hammer's, but larger (See 'Birds of the West of Scotland,' p. 85). There seems to be no reason for supposing that these eggs were anything but white varieties of Yellow-hammer's eggs, and it is remarkable that on the same piece of waste ground Mr. R. Service found on June 16th, 1886, a nest of the Yellow-hammer with three eggs, two of which were practically pure white, while the third had only some very faint speckles (see H. S. Gladstone's 'Birds of Dumfriesshire,' p. 14). The only noticeable difference between the descriptions of the two clutches is that those found by Mr. Kirkpatrick were 'shiny,' while Mr Service's eggs were without gloss. The extreme improbability of the Black Redstart breeding here is emphasized by the fact that no specimen of the Black Redstart has ever been obtained in the county.

Coming to more recent times we find in the 'Zoologist' for

1888, Mr. W. Ogilvie Grant writing that the British Natural History Museum had received, "an interesting acquisition in the shape of an undoubted nest with two eggs of the Black Redstart, *Ruticilla tithys*, taken in Essex. This is the first authentic instance, I believe, which has been recorded of this bird breeding in England." A description of the nest, which was built in a hole of an ivy-covered tree and originally contained four white eggs, follows. The sitting bird is described by the lady who presented the nest as "a dark-coloured bird with a red tail" and this is apparently the sole justification for describing the occurrence as "authentic." Finally Mr. Grant expresses his intention of exhibiting this "most interesting nest and eggs" at the next meeting of the Zoological Society.

I cannot, however, find any record of this having been done, perhaps because Mr. Miller Christy, who carefully inspected the nest and eggs not long afterwards, found them to be undoubtedly those of the Common Redbreast! See the 'Zoologist' 1888. p. 157, when it is suggested that the bird seen may have been an ordinary Redstart nesting near; but from my own experience of a somewhat similar case (which however did not find its way into print) I am inclined to think that it was merely the hen Redbreast, hastily seen by credulous and untrained observers. No notice of the eggs appears in the 'Catalogue of the Eggs' in the British Museum, Vol. 4, so we may presume that the authorities of the British Museum have dispensed with Mr. Grant's "interesting acquisition."

In 1890 Mr. W. Oxenden Hammond reported in the 'Zoologist' (p. 220) a second supposed instance of breeding in Dumfriesshire. In this case the nest was found by a lady in a stone "dyke," so that the site was not unlikely; but as the ground was worked over during that season by no fewer than three experienced field-naturalists, two of whom were resident in the neighbourhood, and all of whom refused to accept the record, there seems no doubt that it was due to the observer mistaking the Common Redstart for the rarer species (*cf.* 'Birds of Dumfriesshire,' p. 15). Mr. Service adds that on two occasions he has been sent for to see supposed Black Redstarts' nests, but both turned out to be the ordinary species.

Up to the present year then, it may be definitely stated that

there has been *no authenticated instance of the Black Redstart breeding in the British Isles*, with the possible exception of Hancock's record from Durham in 1845, which, however, requires confirmation before it can possibly be accepted. It was therefore with considerable surprise that I read in the 'Zoologist' for 1916, p. 237, a note from Mr. N. Orde Powlett, in which he records the finding of a nest in a tin in a rubbish heap in the middle of a field! This is not an unlikely site for a Redbreast's nest, but so improbable for that of the Black Redstart that in itself it is enough to discredit the record. But when it is added that the finder did not notice the birds at all, and Mr. Orde Powlett did not go to the place till the day after, when the eggs were broken and the nest occupied by a Toad, it makes the confidence of the recorder even more remarkable. The Black Redstart, although it frequently nests in outbuildings and sheds, is remarkably wary, and like the Pied Wagtail, unwilling to give away the site of its nest. Why these birds should have continued to stay in the neighbourhood of their ruined nest, is difficult to suggest, even supposing we grant that they were correctly identified. Nothing is said about any second attempt to breed in 1915, though this is the only cause which could have induced the birds to stay there.

Personally I am inclined to believe that the nest was that of the Robin, but it has been suggested that possibly the birds seen had escaped from captivity. This is rendered more probable by the fact that this species has bred in Mr. W. E. Teschemaker's aviaries in Devonshire. Cage birds might possibly allow identification at close quarters in this way, but I see no reason whatever for believing that the bird which laid the eggs in the tin was a wild Black Redstart. It would be interesting to hear the report of some expert on the eggs, which there is every reason to believe will prove to be the white variety of our Common Robin. I should not have written at such length on this subject, but when a record has been allowed to stand unchallenged in print, it is difficult at a future time to prove its worthlessness, and in this case it is necessary that attention should be drawn to the extreme improbability of its correctness at once, in order to avoid the perpetuation of error.

A CONTRIBUTION TO THE LIFE-HISTORY OF THE HERRING-GULL.

By Eric B. Dunlop.

On April 14th, 1915, I arrived at the locality on one of the Lakes of Central Canada, where the following observations were made, travelling over the ice by dog-sleigh. Owing to the warm weather of the previous ten days the ice was already weakening; in fact, the exceptionally early spring weather had caused small patches of open water to show amid the ice in the vicinity of the islands, the current flowing between them wearing the ice away more rapidly than on the open lake.

On going out to an islet, I found that there were many Herring-Gulls (*Larus argentatus*) there; a fur-trapper (a careful observer) who had been in the vicinity for the previous month, and whom I had previously asked to note the arrival of the Gulls, saw the first two birds at this islet on April 6th.

On April 16th there appeared to have been a considerable accession to the numbers of the Gulls during the day; and up up to 10 p.m., if not later, they were making a great noise, calling continuously.

On visiting the islet on April 20th, it was found that the Gulls in some few cases were scratching a hollow out for their nests, and in some of the hollows pieces of vegetation had been placed. This was the last day I was able to reach the Gulls' breeding-place over the ice.

On the 23rd, after some trouble in breaking a passage through the ice, the islet was reached in the skiff, which I had taken out to my camp on a large island by dog-train. On reaching the island I spent some time hidden in a shelter which had been previously erected, but the Gulls left and sat out on the ice, and did not return. The nest-hollows were little different from what they were on the 20th.

On April 25th, a mild day, Double-crested Cormorants (*Phalacrocorax auritus*), which breed on the islet, stayed the night for the first time, though they had visited it on various occasions previously. Probably it was the arrival of the Cormorants for the summer that perturbed the Gulls; whatever the cause, they were greatly excited, and left the place after dark in a body; the concourse, keeping up a continual calling, settled on the water. They kept up their calling most of the night, rising from the water now and again, only to drop down at a fresh place. For several evenings after this they were noted coming in in flocks at dusk, no doubt having been away foraging, though there were always a considerable number of Gulls at the islet; they kept up a continuous clamour, after their arrival in the evenings, up till 11 p.m., and how much later I cannot say.

On April 29th some of the nests had been nearly completed, and on May 2nd many of them appeared to be ready for eggs. On May 4th the Gulls were watched for some time from the blind. No eggs had yet been laid. The birds were standing by their empty nests in pairs. On the 6th they were again standing or lying down near their nests, basking in the sun and preening their feathers, or dozing with their heads under their scapulars. One pair was noted *in coitu*. There were no eggs as yet. I saw many pairs indulging in a curious performance; they stood face to face or side by side, and then jerked their heads upwards rather quickly until their beaks pointed towards the sky, then resuming the normal pose, repeating this time after time in quick succession. The motion was made alternately or in unison; with each uplift of the head a low not unmusical call was uttered. On this and other occasions it was noted that the upward lift of the head varied in extent; sometimes the head and beak were only slightly uptilted, at others the head was jerked up until the beak pointed directly upwards. I saw one pair standing together

on a boulder engaged in this performance; they descended to the ground, then the bird I took to be the female continued the action very vigorously, and pecked several times at the male's beak, when he eventually regurgitated some food which the female at once swallowed. She then immediately reascended the boulder. The hen Gull which I saw *in coitu*, immediately the act was over, commenced to jerk and to utter the subdued note, but the male did not reply in like manner, nor did he feed her. The islet was next visited on May 8th. Two nests now contained single eggs, eighteen days after the commencement of nest-making was first noted; one of these eggs was close to where I saw the birds *in coitu* on the 6th, and doubtless belonged to that pair; this nest eventually held three eggs, one of which was chipped on June 5th. It must be noted, however, that it is frequently several days subsequent to the first springing of the shell that the chick gets clear of the egg. After watching from the blind (my companion having left in the boat) a short time, one of the birds belonging to the nest near which the nuptial act was noted on the 6th, settled and stood about 10 ft. from the nest. A Crow (*Corvus brachyrhynchus*) then settled near by; he made a sudden swoop down towards the nest, and the Gull rushed forward with upraised wings and drove him off; the mate of the Gull also came up and assisted in driving off the would-be thief. After a while the Crow returned and flew past. One of the Gulls ran forward as fast as it could and sat down on the egg; the bird had retired a few feet from the nest and stood there after the first raid. Now it sat on the nest awhile and then returned to its former stance. Again the Crow flew over, and again the Gull ran forward and sat on the egg. The Crow then alighted in front of the nest, and its mate flew up and settled behind. The Gull was very uneasy, calling continually, and a raid on the egg was no doubt intended, but the sitting Gull's mate rushed at one of the Crows with upraised wings and put him to instant flight; the other Crow was also driven off. The Gull continued to incubate the egg for most of the afternoon, though it left it for a short time now and again and sat near the nest. Another pair was observed engaged in the feeding ceremony. The female pecked at the male's beak and then at the ground, indicating thus, it seemed, in dumb show,

that she wished to be fed; both uttered the subdued note and jerked their heads upwards. The male eventually disgorged some food, after running a few feet to one side. This the hen devoured. Then both jerked repeatedly and the hen ran crouching round the cock. He mounted her, and had four or five separate connections before dismounting. It may here be noted that when the head is jerked upwards the subdued note is always uttered too, and that this ceremony is often indulged in without feeding or coition following. Indeed, in about 50 per cent. of the cases noted nothing further ensued. Another pair acted as follows: A male Gull was calling with wide open mouth; his mate was standing near, and, stimulated apparently by the sight of his open mouth, ran up and without any preliminary jerking pecked at the male's beak; she also pecked at the ground. She kept this up without cessation for a full two minutes; the cock then ran a few feet to one side, disgorging a considerable quantity of food on to the ground. Up till then there was no jerking or subdued calling. After the hen had eaten the disgorged food the male commenced jerking and uttering the subdued note; the female replied in a similar manner, and again pecked at the male's beak with no result. The cock then mounted the hen, and coition ensued. The male took the lead in the jerking ceremony, and these and subsequent observations suggest that when the ceremony is initiated by the female she desires food, whereas when the male takes the initiative he is desirous of coition.

In another case noted on this day, coition ensued after the head-jerking ceremony, and several cases were noted of the hen being fed by the male regurgitating food subsequent to the ceremony.

Another form of ceremony was observed to-day and on other occasions. It was as follows: A bird flew in and settled near another; both then commenced bowing their heads up and down, the heads being bent towards the ground all the time, the beak pointing directly towards it; they walked round meanwhile, uttering a note which may perhaps be compared to the "cluck" of a domestic fowl. (The manœuvres of the birds reminded me of Oyster-catchers (*Hæmatopus ostralegus*) when the males are following a female, bobbing their bent heads up and down and

piping). The female was subsequently fed by the male by regurgitation.

I saw several instances of this ceremony, and in more than one case one of the birds bobbed the head until the motion was taken up by the body, and eventually the bird lay flat on the ground on its belly; it then worked the tail from side to side, much in the manner of a male when treading. The meaning of this ceremony is not clear to me, but it undoubtedly has a strong sexual significance.

Having put up a blind on another island, I spent some hours watching the Gulls there on May 14th. The first nest under observation here contained one egg on May 12th and held two on the 14th. After the boat left, one of the Gulls stood near this nest for some time; two Crows then came along, and the bird at once covered the eggs, incubating them. It sat some time and then left the eggs, and was apparently fed by its mate after the jerking ceremony had been gone through; it then returned and incubated. This nest subsequently held three eggs.

The second nest under observation here was empty on the 12th, and held one egg on this day (14th). One of the Gulls, after standing near the nest for some time after the boat left, sat on the egg; it left for a minute or so more than once, but soon returned. Its mate came and stood near. The sitting bird left the nest and indulged in the head-jerking ceremony with no result; it then returned to the nest and incubated. Later the same bird was incubating when the other approached, and lowering its head, uttered the challenge call. The incubating bird at once rose and ran to the other; both then uttered the call, not unlike the clucking of a hen, previously mentioned, and bobbed their heads up and down. The bird which had not been sitting then went to the nest and egg and partially covered them for a few seconds. It then went off, and the bird which had been incubating all the afternoon mounted it and copulation ensued; evidently it was the male that was taking the major share of the incubating duties at this stage. Shortly after a Crow flew near once or twice; the male uttered an agitated call (evidently disturbed by the proximity of the Crow to the egg), and immediately went to the nest and resumed incubation. Later it left the nest and preened its plumage; it approached

the other, and went through the jerking ceremony without result. The other bird now uttered a low deep note which might perhaps be written as "kerr," and went on to the nest and incubated; later a disturbance among the Gulls sent both off in flight. An interesting point which I have been unable to decide, but which is worthy of attention is, does the hen ever feed the cock by regurgitation when he has been taking the chief share in incubation and has been on the nest for a considerable length of time? It certainly appeared in this instance as though the bird which mounted the other was applying for food when the jerking ceremony was subsequently gone through. On May 16th these nests were again kept under observation. At the first nest, soon after the boat left, one of the birds commenced incubation; a little later its mate came up and uttered the call which has been termed by Strong and others the "challenge." The sitting bird at once left the nest and the other walked on and incubated the eggs. Later this bird went off; a Crow settled near, both the Gulls at once flew to the vicinity of the nest, and one of them soon went on. The Crow approached the nest more nearly, the non-incubating bird at once flew up and drove the intruder off. It was noted on various occasions that when a Gull's eggs were threatened by Crows the non-incubating bird always hastened to the assistance of the sitting bird. With regard to the second nest referred to on the 14th, it contained two eggs when I entered the blind at 2 p.m. this day (16th). One of the Gulls soon settled near it and stood there a little while. On a Crow flying past the bird went to the nest and settled down on it. Subsequently it went off, but a Crow flying over caused it to run on again. The Gull called in an agitated manner whilst the Crow was about. After one-and a-half hours the sexes changed on the nest, without ceremony. The bird on the nest appeared to take the initiative and walked off, the other, uttering a few guttural sounds, going on. This bird remained on for the last hour and a half I was there. The non-sitting bird in both cases always stood near at hand.

This nest, as previously noted, contained two eggs at 2 p.m.; when I left at 5 p.m. it held three. At about 4.30 p.m. I noticed that the sitting bird was very restless, and I have no doubt that it was the second bird to go on that laid the egg. Another nest

near by that contained one egg at 2 p.m. held two at 5 p.m. The eggs appear to be laid every other day, as a general rule, but there is some variation in this respect, for the interval may be longer or shorter. It may here be noted that a male Gull shot on June 12th showed a large incubation-patch, proof that the males undertake their full share of the incubatory duties.

As has been shown in this record of observations, both sexes incubate from the laying of the first egg. The following are the the particulars of the hatching-out of four clutches of Herring Gulls' eggs.

I. Three eggs.	*June* 23*rd*.	One young one out and dry, one egg chipped, one unchipped.
	,, 24*th*.	No change.
	,, 25*th*.	Second out; third did not hatch.
II. Two eggs.	,, 26*th*.	One well chipped, one slightly.
	,, 27*th*.	No change.
	,, 28*th*.	One out.
	,, 29*th*.	No change.
	,, 30*th*.	Second out.
III. Three eggs.	,, 25*th*.	One chipped.
	,, 26*th*.	Two out; third chipped.
	,, 27*th*.	Third out.
IV. Two eggs.	,, 26*th*.	One just out; one chipped.
	,, 27*th*.	No change.
	,, 28*th*.	No change.
	,, 29*th*.	Second out.

The shells of hatched eggs are commonly left lying within a few yards of the nest. The Herring-Gull does not void the fæces from the nest. The Kittiwake is the only Gull with which I am acquainted that habitually does so.

On May 17th two birds were seen jerking their heads and uttering the subdued call, not close together as usual, but one on the island and one on a stone in the water 10 yards away. On another occasion I saw a Gull swimming on the lake going through the jerking ceremony, but its mate on the water by it did not respond. It appears to be unusual for the ceremony to be gone through unless the birds are standing close together on land. In one instance two Gulls were seen together, one of which was uttering the subdued note and jerking; the other brought

up food which the first took, some of it from its mate's mouth before it reached the ground. Usually both sexes utter the subdued note, one replying to the other, but occasionally the solicited one does not reply, as in this instance. One of these Gulls was observed to pick up a piece of nesting-material and commence the jerking and calling ceremony with it in its beak. Both birds of a pair were also seen carrying nesting-material, though the actual nest-making was not witnessed; no doubt both sexes take their part in this work.

The last date on which I watched the Herring-Gulls was June 17th. Young had been out for some little time. The clucking note was still to be heard and also the subdued note. The latter call consists either of a single squeak or is double-noted, and may perhaps be written as "oo-ee," the second note being higher pitched than the first; occasionally a third note is uttered. This call is not unlike the squeak of the young when calling for food or shelter, and is probably derived from it, for the female uses this call and accompanying jerking ceremony when desiring food from the male. We may compare the behaviour of the Gull to that of the female European Rook, for on the arrival at the nest of the male with food she utters a call resembling that of the young, and flaps her wings in a manner similar to that of the fledgling Rooks when being fed. The reversion to the manners of youth is not an unusual phenomenon during the breeding-season of animals. Young Gulls which disperse on the approach of humans return to the nest as soon as quiet is restored, and so are easily found by their parents.

With regard to the feeding of its mate by regurgitation in the case of the Herring-Gull, it may be noted that this is not the only Gull I have seen to act thus; the Ring-billed Gull (*Larus delawarensis*) was also noted feeding its mate in this manner after the eggs had been laid. It may be noted that I have watched the Common Tern fishing assiduously for his mate before egg-laying had commenced, the female sitting for hours on a stone in the water, whilst the male flew up and down seeking to secure a meal for his lady-love; whenever a catch was made he at once flew straight to his mate and delivered the fish into her beak. This I have observed on various occasions.

The records of Gulls immediately covering their eggs and

incubating on the approach of Crows, appear to me to be proof that the incubating from the first egg in this (and also many other) species is a protective habit, which preserves the eggs. This I have previously endeavoured to make clear (*cf.* 'British Birds,' vol. iv, pp. 137–45; vol. v, pp. 322–27; vol. vii, pp. 105–14).

That selection is close was obvious, for the Crows succeeded in taking Gulls' eggs not infrequently.

ORNITHOLOGICAL NOTES FROM SOUTH MAYO.

By Robert F. Ruttledge.

This spring, though a little late, was, however, much earlier than last year's, and migrants were observed nearly as early as in previous years.

The Willow-Wren arrived on April 4th, whereas last year it was not observed until April 22nd.

The following day Chiff-chaffs were singing, about a fortnight earlier than last year.

Nearly every evening White-fronted Geese were observed; they are very numerous here in winter and in spring until the middle of April; after that they appear in smaller numbers.

On April 8th my brother and I went to a bog-lake not far from here; Black-headed Gulls were very numerous, as were also Common Gulls. We noticed three Ringed Plover on the muddy shore. On one side of the lake is a long stretch of shingle where the Ringed Plover built last year, and we therefore expected they would do so again this year. However, we searched in vain that day; apparently they had not started to nest yet. Redshanks, Curlew, and Green Plover were about in numbers, and in the evening large flocks and some couples of Golden Plover began to sweep in and settle on the shores. At 7.20 p.m. Geese began to arrive; a flock of forty-three flew down to the water about 15 ft. above our place of concealment,

giving us an excellent view of their white foreheads and of their plumage. During the course of the evening many arrived, and we saw some 154 in all.

On April 9th, a pair of Long-tailed Tits were discovered building.

Large numbers of Goldfinches were seen about the garden from April 10th to April 14th, and the paths were covered with Lesser Redpolls through the greater part of April. On April 11th and 14th, Jack Snipe were still in the bogs, and the last was observed on April 20th.

As usual, Redshanks and Teal were very conspicuous on all the bog-lakes, and Curlew were still in flocks on April 27th, though after that the flocks began to break up into couples.

From April 18th onwards we spent nearly every evening trying to discover out of what woods some Woodcock were coming, as we were sure they were nesting.

Every evening they would suddenly appear, flying up and down certain woods uttering the curious "croak" repeated three times and then followed by a "squeak."

One evening, while we were waiting, one circled round and settled on a marshy spot eleven yards away; it was dusk, and the bird was not easy to see, but its breast showed up well as it fed and moved about. It remained there for about half an hour.

The 19th found us watching them again; three were seen at one time and from now every evening they performed just the same flights. On some occasions the bird flew so low overhead that the throat could be seen to quiver when it uttered the notes. I may say that these birds occupied our attention every evening until the end of April, when, after investigating different woods, etc., we abandoned the search for their "rising-place." Anyway, it seems certain that they nest here fairly numerously, but this is, of course, no uncommon occurrence.

The weather, up to this, had been harsh, but the 20th was a glorious day and new life was in all the birds, which were singing heartily, and many were busy building. The woods swarmed with Chiffchaffs and Willow-Wrens, all singing loudly.

Sand-Martins were first noticed on April 20th.

While looking for a Water-Rail's nest on the afternoon of the

20th I found a Snipe's nest containing eggs. Snipe nest commonly on the bogs, and the males "drum" incessantly all day and all night; they also utter their other two notes while in the air and on the ground.

The first Swallow appeared on April 22nd, which is the same date as its arrival last year.

After being absent for a little time, Redpolls were again very numerous on April 24th.

On April 25th we cycled to the northern end of Lough Carra; the first find was a Redshanks' nest with eggs, on a bog which we crossed on the way; here we also found Green Plover nesting. In a bay below Moore Hall a pair of Great Crested Grebes were feeding; they are fairly numerous on the lake.

Tufted Duck were to be seen in most of the bays, and Mallard were very numerous.

Derrinrush, a long peninsula, is a paradise for Warblers, being densely covered with natural timber growth. At one spot, on the way back, we noticed Sand-Martins innumerable, and we saw the first Swift.

Round the coasts several Water-Rails were put up.

Corncrakes were first heard on April 26th.

On April 27th House-Martins were seen early in the morning, and they went straight to the old nests. These birds are far more plentiful this year than I have ever seen them at this place.

The Cuckoo was first heard on April 27th (this is the third year running it has arrived on this date).

In the afternoon of the 27th we again visited the bog-lake where the Ringed Plover nest; this time we observed four and later found a nest with four eggs. Along with flocks of Curlew there were many Whimbrels; in some cases they mixed with the Curlew and sometimes were in flocks by themselves. Whimbrels were numerous over the bogs for about a fortnight after this.

April 29th was spent visiting the islands of Lough Carra.* It was rather early for the nests of some species, but we found some Wild Ducks' nests and a colony of nesting Common Gulls; Tufted Duck were numerous, as were also Common Sandpipers.

* 'Irish Naturalist,' vol. xxv, pp. 96, 97.

A few Terns were about; they nest on one island in the lake. The last White-fronted Geese were seen that day.

Corncrakes were now numerous, far more so than I have seen them for about six years; they might be seen and heard in the hayfields every evening.

A little way from here, on May 3rd, a Sedge-Warbler was singing, and from this date they might be heard every day.

The next day we set off to the northern end of Lough Mask. On the way we found a colony of Sand-Martins nesting in the sides of a raised road across a bog; there is a great scarcity of sand-pits in the country, and it is not uncommon for Sand-Martins to nest in turf-banks (see Ussher's 'List of Irish Birds,' p. 17).

In the hills near Lough Mask birds were extraordinarily scarce—only a few Meadow-Pipits and Cuckoos; in one bay we saw a pair of Red-breasted Mergansers, and Common Sandpipers were about the shores.

An arm of the lake goes back into the country like a river and then forms a small lake: here there were no less than eighteen Mute Swans; also a few Terns and a flock of Curlew along with some Whimbrels.

Finches were to be found in flocks on the newly sown oats at the end of the first week of May, nearly all having deserted the yards.

On May 11th, after half an hour's search, we found three young Redshanks, which could not have been hatched many days.

An interesting record is that of the occurrence of a Nightjar at the Blackrock. It landed there exhausted in October last and died in a few days.

A pure white Curlew was shot by a local fowler last winter.

NOTES AND QUERIES.

MAMMALIA.

Rats and Eggs.—The correspondence on this question in the 'Zoologist' has been interesting. I have in two or three episodes in my career been much worried by the doings of the Brown Rat (*Mus decumanus*). When managing a small zoo in Lancashire in the early '80's, I found the grounds, to start with, riddled with their burrows, the sides of a small lake being honeycombed. I never recovered any eggs laid by the waterfowl, and placed it to the charge of these animals, until I had reasons to suspect the gardeners (!) They burrowed into my pheasantries, whither they came primarily for corn—I often found pheasant eggs, of various species, half covered by the burrowings of the previous night; I never saw a broken one, nor empty shells. My predecessor had allowed even the keeper's house to be absolutely undermined, as well as bird-rooms and monkey-house. I at length gave up in despair. Black Rats (*Mus rattus*) have for years been a great pest in the local grocers' warehouses, in maltings, fish-houses, etc. They will literally burrow into date-boxes, and lick out jam-pots, but never has any grocer been able to assure me that they interfered much with eggs, although one informed me that he had on one occasion, when taking up some floor-boards, discovered several unbroken eggs of an unknown date on the outside of a nest of Rats. In no single instance could a grocer recall an egg broken by them.—A. H. Patterson (Great Yarmouth).

Do Rats Eat the Eggs of Poultry?—Referring to Dr. Laver's inquiry (*ante*, p. 395), the Rats which infest my poultry-runs alluded to in my communication (*ante*, p. 352) are certainly the Norway Rat and not the Water-Vole. I question whether the latter species occurs within a quarter of a mile from where I keep my poultry, certainly not in large numbers. What attracts the Norway Rat to the wood where I keep my hens, no doubt is largely the refuse which is put into the stream from the fish-shop higher up the valley. I should not like Dr. Laver to suppose that because the Rats on my run are not guilty of eating eggs, therefore Rats in other districts are equally immune from this proclivity. In the area to which my note refers, this immunity may be ascribed to the abundance of more suitable food. Whatever may be the reason, I have never once in four years found any egg-shells in or about my hen-cotes. I need hardly say

that animals, using the term in its widest sense, when pressed with hunger, will eat almost anything.—E. P. Butterfield (Wilsden).

Nesting of Rats and a Sequel.—The following incident, which might have terminated in serious consequences, took place in Bedfordshire a few years ago. A payment of £20 was to have been made to an illiterate person to whom the knowledge of payment by cheque was limited so that cash was preferred. As the man failed to call for the money as arranged, it was wrapped up in a piece of newspaper and hidden away in some wood, in the manger of an old stable which was then serving as a workshop. A day or so following, the employer had occasion to take away half a sovereign from this amount, and in so doing possibly revealed the hiding-place to a man who was employed by him in that workshop. When the money was required, about a week afterwards, it was missing, and suspicion naturally fell upon the man who was the only person that had access to this particular part of the premises. This was supported further when soon afterwards the man left his employment and after taking a holiday at the seaside, then purchased tools, etc., and set up in business on his own account. The venture proved unsuccessful and once again the man was offered employment, provided he could give a satisfactory account of where the money came from with which he had commenced his former business, and show that he had had no hand in the removal of the missing gold. The explanation was given that the money was loaned to him by a sister, and he requested his former employer to interview her. For various reasons, and partly from the wish not to bring in a third party, this course was not pursued and the man was eventually reinstated. When I personally raised the question of the wisdom of such an action with the employer, he remarked: "Perhaps it is better to employ a man one suspects is dishonest, and keep temptation out of his way, than take another one knows less about." In the meantime the business, excepting this one workshop, had been removed to another part of the town. Some twelve months later this man went to see his employer, and took with him £9 10*s*. in loose gold which he had found in some rubbish that Rats had scratched out between the timber stacked upon the earthen floor. The following morning all the timber was removed, the accumulation of rubbish sifted, and the remaining £10 recovered; the explanation, of course, being that the newspaper in which the money was wrapped had been dragged away some 20 ft. distant along the manger and been used for nesting purposes in the meantime, and afterwards displaced, with the gold, by renewed burrowings of these or other Rats.—J. Steele Elliott.

AVES.

Migration in Bedfordshire.—In a recent note to the 'Zoologist' (p. 314) I wrote of the migrant bird-life frequenting the Bedford Sewerage Farm at Newnham, which is situated in the adjoining parish of Goldington. Reference was also made to the present existing open sewage conditions that are being replaced by septic tank principles, which changes have been delayed in completion until the war is over. When these are in readiness the present 100 acres or so of attractive feeding-grounds will be no more, and many of the rarer spring and autumn migrants will pass over unheeded and probably hardly credited in years to come. From the latter end of July to the end of September practically hardly a day passes but one can see at least some migrant of interest that may throw a little more light on the subject of this flight-line that passes along the Ouse valley. A recent visit to this locality gives a fair indication of what birds may be met with in a county so far remote from the coast-line movements. On September 1st I visited the farm in the evening, but unfortunately not until darkness was coming on, and the failing light prevented my making any prolonged observations. A Curlew was most conspicuous by its noisy callings and wary movements, and a solitary Dunlin, still in the breeding plumage, could be seen with the aid of field-glasses; but three other smaller waders, although within twenty yards, could not be satisfactorily identified. Several Green Sandpipers were calling frequently, and a large number of Snipe were "scaping" freely around wherever I wandered. Two Tufted Duck were swimming on a pool of drainage water in a disused gravel pit. On September 3rd the following species were observed: 5 immature Sheld-Duck, 1 Tufted Duck, 5 Ring-Plover, 3 Greenshank, 1 Redshank, 2 Green Sandpipers, 4 Common Sandpipers, 1 Dunlin in winter plumage, and, in addition, fully 50 Snipe were observed (one of which was heard "drumming" for a short time), and the usual large number of Lapwings, Moorhens, Rooks, Jackdaws, Starlings, Pied and Yellow Wagtails, and a few Meadow Pipits, with the other more or less general bird-life found there practically throughout the year.—J. Steele Elliott.

Stonechat near Wilsden, Yorks.—As I was returning home from Bingley Wood on the afternoon of September 30th, I saw at a distance what I took to be a Whinchat; but on a nearer approach I saw it was a Stonechat, the very first I have ever seen alive in this immediate neighbourhood. It is not often seen here in the autumn, but is sometimes met with on migration on the high ground in early

spring, but scarcely ever remains to breed.—E. P. Butterfield (Wilsden).

House-Martins' Nests usurped by House-Sparrows.—Referring to my note (*ante*, p. 356) with regard to the usurpation by the House-Sparrow of the Martins' nests built on the south side of a public-house near here last summer, I asked the landlord this summer if the Martins returned this spring, and he replied that two pairs commenced to nest on the north side, but did not bring off their young; whether the nests were again appropriated by the Sparrows I was unable to ascertain. Of course a good many Martins' nests built in this village are never molested at all by Sparrows, but this may be, as remarked in the editorial footnote, because there may be sufficient nesting-sites for the Sparrows. As to Mr. Cocks's note (*ante*, p. 357) the nests of House-Martins here are built facing every point of the compass, and I quite agree with Mr. Cocks that architectural considerations have some influence in the selection of nesting-sites. Referring to the Rev. J. G. Wood's remarks, quoted by Mr. Cocks, it would be interesting to have the matter definitely settled, whether, of walls with a north-eastern or southern aspect, other things being equal, the former is the more favoured nesting-site of this species. My own impression is that if the eaves of a building projected considerably, so as to afford complete protection, the House-Martin would prefer to build its nest on a wall having a southern rather than a north-eastern aspect; but on this point I should not like to be dogmatic.—E. P. Butterfield.

House-Martins and Sparrows.—When I was a lad we had no end of nests of the House-Martin located in various parts of the town; they, for the greater part, built their nests facing north and east, although a number favoured opposite points of the compass. To-day these birds rarely put up a nest in the neighbourhood, having for the past few years been most unmercifully interfered with by the ever-increasing Sparrows. One can almost always discover when a nest has been usurped by the long loose straws depending from it. Only on one house do the Martins now yearly attempt to build, facing the east, but rarely does a pair succeed in keeping out the intruders. The use of sea-water for watering the streets and roads has discouraged others by the consequent want of tenacity and endurance of their mortar in prolonged moist weather.—A. H. Patterson (Great Yarmouth).

Swallows Building in Chimneys.—In three instances only have I met with the "Chimney" Swallow building in local chimneys. One

nest was located in a big old-fashioned stack that was in fairly constant use; the other two were built in two, half a mile apart, tall brick ventilation shafts erected over a main sewer, as evil-scented a selection as could be well imagined. These shafts have since been removed. The Swallows' local favourite nesting-places are the numerous pump-mills, steam- and wind-driven, dotted all over the vast spreading marshes, where the Yare, Waverley, and Bure meander among our East Coast lowlands. Cowsheds and barns are also largely used by this species. I have seen many nests in walls where bricks have crumbled away, and on beams, often on top, sometimes at the sides resting on big nails. On one occasion I saw a nest built on an inch-thick iron rail, shaped like a saucer, with dabs of clay on each side to shore it up safely as with brackets. Broken panes of glass are often the only means of in- and egress; whilst those birds building in boat-houses use the space between the water and the bottom of the doors.—ARTHUR H. PATTERSON.

ANTHOZOA.

Sagartia parasitica Mounting on Solaster and Hyas.—It is well known that the commensal Sea-Anemone *Sagartia parasitica* will move freely from one empty shell to another in an aquarium, and probably many aquarium-keepers know that it is able to mount upon the shell of a passing Hermit-Crab, but I believe that no instance has so far been recorded of this Sea-Anemone mounting upon a passing Starfish. On May 25th, 1916, a Sun-Star (*Solaster papposus*) of 95 mm. in diameter was creeping slowly past an average-sized Sea-Anenone, attached to the side of a stone in an aquarium, when the Sea-Anemone quickly pressed its disc upon the Sun-Star, as it would have pressed it on the shell of a passing Hermit-Crab (see p. 39 of the present volume of the 'Zoologist'). The Sea-Anemone adhered to the Sun-Star and was actually dragged along the bed of the tank for several inches. The Sea-Anemone was then able to attach its base to a rock, and a short tug-of-war ensued between the Sun-Star and the Sea-Anemone, the latter eventually releasing its hold of the Sun-Star but remaining attached to the rock. The whole affair occupied only a few minutes. E. Howard Birchall mentioned in 1876 (in a note in the 'Zoologist,' vol. xxxiv, p. 5129) that *Sagartia parasitica* might "often" be found attached to the limbs of the Great Spider-Crab (*Maia squinado*). It would be interesting to know how often such specimens are observed. I have myself seen in a tank one of these Sea-Anemones firmly grasp with its base one leg of a large Common Spider-Crab (*Hyas araneus*) to which it remained attached.—H. N. MILLIGAN.

NOTICES OF NEW BOOKS.

Yorkshire's Contribution to Science. By T. Sheppard, M.Sc., F.G.S., etc. London: A. Brown & Sons, Ltd. 1916. 5*s.* net.

In this neat volume of nearly 260 pages Mr. Sheppard has a great deal to tell us not only about Yorkshiremen in their relation to science, but other subjects of more general interest, for not only does he devote sections to a topographical review of Yorkshire publications, and to Yorkshire scientific magazines living and extinct, but he has a most interesting and valuable summary of general natural history journals, many of which, of course, are now things of the past—for extinction seems to be the usual fate of such ventures—and of the publications of scientific societies, including those dealing with geology and archæological matters. An index to these concludes the work, which begins with a bright presidential address by Mr. Sheppard to the Yorkshire Naturalists' Union. We note two important omissions in the list of journals not specially concerned with Yorkshire—no mention is made of the 'Avicultural Magazine' or of 'Bird Notes,' nor of the Avicultural Society and the Foreign Bird Club, by which they are respectively published; yet these journals deserve attention if only for the beauty and utility of their coloured illustrations, to say nothing of their often including items of wide scientific interest. But this is but a slight blemish in a valuable and generally scholarly work.

Growth in Length. By Richard Assheton, M.A., Sc.D., F.R.S., Cambridge University Press. 1916. 2*s.* 6*d.* net.

The first part of this posthumous work has been prepared for publication by the author's widow, with the assistance of Professors Stanley Gardiner and J. P. Hill; the figures, which number forty-two, are from the author's sketches. The sub-title is "Embryological Essays," and the first part of the book comprises three lectures given as one of the "Advanced Courses of Zoology" in the University of London, under the title of "The Growth in Length of the Vertebrate Embryo." The second part is a reprint of a paper on the "Mechanics of Gastrulation," which appeared in the 'Archiv für Entwicklungsmechanik der Organismen' in 1910; it will be particularly appreciated by those interested in embryology, because further copies are now unobtainable. A full bibliography is given, and the whole length of the work, which is well got up, is 104 pages.

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THE ZOOLOGIST

No. 906.—December 15th, 1916.

ORNITHOLOGICAL REPORT FOR THE MALTESE ISLANDS (JANUARY—JUNE, 1916).

By G. Despott, M.B.O.U.,

Nat. Hist. Museum, Malta.

Although no new species has been added to the list of the birds of Malta during the first six months of 1916, nevertheless, besides several rarities, we had one occurrence which will serve to confirm what has till now figured on our list with some doubt. This is that of the Black-bellied Sand-Grouse, about which I published a short note in the 'Zoologist' for May at page 231.

Besides that of the Quails, which on April 28th arrived in considerable numbers, when at Nadur (Gozo) alone more than 2000 were taken, another passage of birds worth recording is that which occurred on March 25th, when Hoopoes, Wrynecks, Rock-Thrushes, and Wheatears came over in abundance, on which grave havoc was made by sportsmen, as will be seen from the note of the day following, in the body of this report.

Large flocks of Purple Herons passed over the island on April 6th, and a most abundant arrival of Scops Owls was noticed on the following day.

Rather noteworthy is the almost total absence of all sorts of Ducks, which are usually frequent, especially during the first months of the year.

Amongst the rarities, besides the above-mentioned Sand-

Grouse, I noted a few Dartford Warblers, and obtained two Egyptian Nightjars and a Redwing. I saw two Rooks, heard of the occurrence of three others, and heard of the capture of half-a-dozen Storks—three of which were taken at the southern end of the island, the other three at the opposite end; of these I obtained one (about two of these Storks I published also a short note in the 'Zoologist' for June at page 232).

The Cream-coloured Coursers, which are here rare and irregular visitors, appeared in fairly good numbers during this period; they made their first appearance towards the end of February, and for the whole of April continued to be met with.

The varieties in plumage I noticed comprised a perfect albino Spanish Sparrow, taken in the vicinity of Krendi, a melanic form of the Corn-Bunting shot at Binghisa, and a pied Turtle-Dove taken in the nets at the neighbourhood of Melliha.

During the breeding-season the Corn-Bunting seems to have nested more freely than usual, while the nesting of both the Sardinian and Spectacled Warblers appeared to be on the decrease. Most noticable, however, and in some localities especially, was the scarcity of Sparrows' nests; and yet these birds were once considered to be a nuisance. A few Linnets nested, especially in Gozo. The majority of the nests, however, were taken before the birds were fledged. A pair of Kestrels nested in the vicinity of Krendi, and I was told that a Serin's nest was found at Boschetto. The Herring-Gull, I was told, nested also in fairly good numbers, and some of their eggs were brought into the market too. Happily the Blue Rock-Thrush was not much molested during the breeding-season; in fact I do not know of a single nest that was brought over to the dealers in town.

January.

1st.—A moderate wind blew from the W.S.W.; some Plovers and a few Dotterels, also one or two Woodcocks. Many Adriatic Gulls were seen passing in a northerly direction.

2nd.—The wind continued to be moderate, but turned somewhat towards the south; there seemed to be a good passage of Golden Plovers.

4th.—I passed a whole day in the country about Imtahleb.

The only birds I observed there were a few Larks, some Pipits, and one Dartford Warbler, at the bottom of the valley; a fresh wind blew from the S.W.

5th.—A very light N.W. wind; a Shoveller was shot at the Ghadira (Melliha) by Col. Francia, who sent it over to me.

7th.—A strong N.N.W. wind; many Thrushes. A Redwing was taken in the neighbourhood of Zurrico.

12th.—A fresh north-westerly wind, with a little rain. I observed three Firecrests in Col. Francia's garden at Casa Lia. I was told that several of these birds were noticed at the Botanical and Maglio Gardens in Floriana.

14th.—A rather strong north-westerly wind, with a shower every now and then. I observed a Dartford Warbler in a garden at Sliema, and a Blackcap in the Argotti Botanical Gardens, where Firecrests seemed pretty common.

15th.—A moderate north wind; there was what appeared to be a good passage of Song-Thrushes, and one or two Golden Plovers.

16th.—The wind to-day was a light N.W., and we had a pretty good passage of Song-Thrushes; also a few Blackbirds, Lapwings, and Golden Plovers. I saw the first Wryneck of the season brought into the market. Lieut. Jessop of the West Yorkshire Regiment reported to me that he had seen three Black Redstarts, some Pipits, Stonechats, and Wagtails, in the vicinity of Città Vecchia.

20th.—A strong E.S.E. wind. I passed the whole day out in the country around Birzebbugia. The birds I observed were some flocks of Larks, terribly frightened at the continuous volleys shot at them by half-a-dozen sportsmen. I noticed also a Kestrel and some Spectacled and Sardinian Warblers; also one Subalpine Warbler. The Corn-Bunting's note could be heard continuously in all directions.

21st.—A Great Crested Grebe was brought into the market at Valletta.

22nd.—I saw the first Scops Owl of the season brought into the market. The wind blew rather strong from the W.N.W., and we had a pretty good passage of Song-Thrushes and a few Scops Owls.

25th.—The same wind as that of the 22nd, and another

rather plentiful passage of Song-Thrushes; also a few Golden Plovers and Pipits, some White Wagtails, and many Larks.

26th.—Wind blowing milder from the same direction. Song-Thrushes again plentiful. Sparrows showed increase (but always scarce), and nests with eggs could already be found.

28th.—A Short-eared Owl was exposed for sale on one of the stalls at the market.

February.

4th.—Several dozens of Sparrows and other small birds were taken by means of the bat-net and brought into the market, where I observed also some Thrushes and one Scops Owl.

5th.—Weather-cocks pointing to the W.N.W. Some Snipes were observed, and a few taken; there were many Starlings, plucked of their feathers, in the market.

7th.—A very light wind from the W.S.W. Snipes again; also some Jack Snipes, a few Golden Plovers and Lapwings; also one or two Blackbirds.

11th.—The wind blowing moderately from the S.S.W. This brought many Song-Thrushes, which arrived during the night; in the valleys a few Scops Owls were observed. Golden Plovers and Ruffs were seen at the Marsa and Salina; at this last locality a few were also taken.

12th.—The wind increased in force, and we had a passage of Song-Thrushes, with some Blackbirds.

15th.—The only birds brought into the market were some Quails, Thrushes, and Larks, three Linnets, one Robin, two Jackdaws, and two Golden Plovers.

20th.—A moderate wind from the west; a few Lapwings and Plovers were observed. Four or five Teal came into Marsascirocco Bay, and two were shot on the fish-ponds.

21st.—A Spotted Crake, a Teal, and two Lapwings at the market.

22nd.—A Shelduck was sent to me from the market; it was killed the day before at the fish-ponds at Marsa Scala.

23rd.—I went to Gozo, where the absence of birds was simply astonishing—in fact, besides a few Sparrows, the only bird I saw was a Robin; but I heard the note of the Corn-Bunting.

25th.—Two Song-Thrushes, five Quails, one Dotterel, and two Plovers were the only birds brought into the market. The wind to-day blew moderately from the N.N.W., and we had a little rain. Some Harriers came over against the wind; we had also some Song-Thrushes. Mr. Gera reported to me that he had received a Cream-coloured Courser which was taken at the Marsa.

26th.—The wind the same both in force and direction; a shower every now and then. Some Dotterels, Plovers, and Song-Thrushes were observed. A Teal was killed at the fish-ponds at Marsa Scala, and two Jack Snipes at the Marsa.

27th.—A fresh north wind and a little rain. Spotted Crakes, Snipes, Golden Plovers, and Dotterels were observed in fairly good numbers, some being also taken.

29th.—A few Hoopoes arrived, and a few were also taken; we had also some Plovers, Ruffs, and an occasional Redshank.

March.

1st.—A moderate south-westerly wind. Some Snipes and Song-Thrushes; also three Redshanks, of which one was taken. A Bittern was sent to me from the market; this had been shot the day before on Gozo.

3rd.—I found in the market a melanic form of the Common Bunting and two Quails, one of which had a fully-developed egg.

6th.—A Black Redstart was sent to me from the market. The wind to-day blew moderately from the S.W. Some Hoopoes and Song-Thrushes were seen, and a few taken; there appeared also an occasional Spotted Crake and a few Ruffs. The Wryneck's note was often heard. In the afternoon a few Lapwings came over from the N.W., the wind at this time having changed to a light S.E.

12th.—A fresh wind blew from the south. I observed a Chaffinch, some Greenfinches, some Starlings, two Hoopoes, some Song-Thrushes, many Larks, Titlarks, and Green Sandpipers. Towards sunset three Plovers came from a north-westerly direction.

14th.—An Egyptian Nightjar and a Whimbrel were sent to me from the market; the Nightjar was shot the day before at Binghisa by a sportsman from Zurrico. In the market I

observed some Song-Thrushes and Quails, and one Scops Owl. The wind to-day was a very light S.E. Some Song-Thrushes were seen, and some taken. In the valleys there were a few Scops Owls.

15th.—At market. Some Quails, Song-Thrushes, one Lesser Kestrel, four Scops Owls, one Snipe, one Jack Snipe, one Reeve, one Green Sandpiper, two Spotted Crakes, and one Pintail.

17th.—Amongst several other birds I found in the market were one Corn-Bunting, two Hoopoes, one Scops Owl, one Short-eared Owl, one Marsh and one Montagu's Harrier, one Green Sandpiper, three Reeves and one Ruff, one Teal, one Moorhen, one Snipe, and two Spotted Crakes.

18th.—At the market again. I noticed two Teal, one Short-eared Owl, one male Montagu's Harrier, and one Cream-coloured Courser. The wind to-day was very light W.N.W. Short-toed Larks were noticed coming in from a south-westerly direction.

21st.—At the market, amongst other birds, I noticed a Short-eared and a Scops Owl, a Dotterel, a Golden Plover, and six Short-toed Larks.

22nd.—I passed a day at Comino. On the islet I observed a few Short-toed Larks, some Sardinian and Subalpine Warblers, a Southern Herring-Gull, and two Mediterranean Shearwaters. On my way back to Valletta from Marfa, passing through St. Paul's Bay, I saw many Swallows and Martins flying along the road. To-day we had a good passage of several species of Wagtails and some Lesser Kestrels.

24th.—A light wind varying from S. to S.W. Some Pintails alighted on the fish-ponds in Marsascirocco; a pair of these were taken and brought into the market.

25th.—A light wind from the N.W. brought us a fairly good passage of various Wagtails and Short-toed Larks, which were observed to come in from the S.E. Some Stilts came over also from the same direction, of which some were also taken.

26th.—A moderate north-westerly wind; we had rain during almost the whole night. This brought to us a large number of Hoopoes, Wheatears, Rock-Thrushes, Herons, Wrynecks, Sandpipers, Harriers, Kestrels, Owls, Crakes, etc.

27th.—The birds noted at the market to-day were the following: 126 Hoopoes, 32 Wheatears, 79 Wrynecks, 288

Rock-Thrushes, 6 Larks, 3 Redshanks, 3 Marsh-Harriers, 5 Montagu's Harriers, 4 Moorhens, 4 Spotted Crakes, 1 Short-eared Owl, 8 Scops Owls, 1 Bittern, 1 Purple Heron, 17 Spanish Sparrows, 75 Quails, 12 Song-Thrushes, 2 Ringed Plovers, 2 Stone-Curlews, 2 Kestrels, and 1 Lesser Kestrel.

28th.—A light southerly wind. Turtle Doves were noted for the first time in the season; we had also a good passage of Scops Owls, Hoopoes, and Rock-Thrushes. A Whimbrel was killed at Melliha.

30th.—A light wind from the S.E. brought over a fairly good number of Goldfinches, some of which were taken in the clap-nets by the bird-catchers of Binghisa and Zurrico.

April.

1st.—At the Valletta Market I found one Short-eared and five Scops Owls, two Cream-coloured Coursers, and an Egyptian Nightjar; I could not find out where this last was taken. I know, however, that it had been taken the day before.

2nd.—Four clutches (three eggs each) of the Southern Herring-Gull were brought over to the market; these I bought, and found that only one was slightly incubated, the remaining three being perfectly fresh.

3rd.—The birds brought into the market this day were the following: 202 Quails, 1 Ringed Plover, 1 Wryneck, 2 Green Sandpipers, 2 Ruffs, 1 Pipit, 1 Dotterel, 1 Harrier, 7 Hoopoes, 1 Sparrow, 11 Scops Owls, and 1 Nightjar.

4th.—A very light wind, varying from E. to S.; we had a very plentiful passage of several species of Harriers and Hawks, amongst which great havoc was made by sportsmen.

5th.—A moderate E.S.E. wind; we had a good passage of Purple and Night Herons. The carob-trees were said to be full of Scops Owls to-day, and the so-called sportsman is said to have enjoyed himself much with the birds.

6th.—A strong wind from the E.S.E.; we had more than 1 inch of rain. This brought over to us a great number of Night and Purple Herons, many Hoopoes, Scops Owls, Harriers, Nightjars, Wrynecks, and Cuckoos; also a few Turtle-Doves, Wheatears, and Rollers.

7th.—I noted the following birds in the Valletta Market:

1 Black-winged Stilt, 1 Moorhen, 3 Kestrels, 23 Scops Owls, 53 Quails, 27 Hoopoes, 17 Nightjars, 15 Wrynecks, 9 Cuckoos, 7 Marsh and 5 Montagu's Harriers, 5 Turtle-Doves, 7 Wheatears, 1 Roller, 11 Night and 62 Purple Herons; the majority of these last found their way to the tables of the French men-of-war in the harbour.

8th.—A light westerly wind; we had a most abundant passage of Scops Owls, amongst which the so-called sportsmen wrought the greatest havoc. Great Plovers, Hoopoes, Purple and Night Herons, Sandpipers, and several other waders arrived also in fairly good numbers. A pair of Glossy Ibises was shot from the neighbourhood of Marsa Scala.

Amongst the other birds in the Valletta Market I counted 227 Scops Owls. With the dealers on St. John's Square I observed eleven live Moorhens, which were brought over from Gozo. A Golden Oriole was taken in the limits of Wardia, this being the first specimen which, as far as I am aware, was taken in the season. Other birds noticed to-day were a few Turtle-Doves, Wrynecks, and Spotted Crakes, seven Lesser Kestrels, two of which were taken, and a pretty good number of Scops Owls.

9th.—A moderate wind, varying from N.N.W. to W.N.W.; a plentiful supply of Swallows and Martins, many Scops Owls, Nightjars, and Hoopoes; also Wrynecks, Rock-Thrushes, Pipits, and a few waders.

10th.—Almost calm. Many Blue-headed Wagtails came over from the N.W.; of these many were taken in the clap-nets. Short-toed Larks and Hoopoes were seen in fairly good numbers, and a few Little Bitterns were taken.

11th.—Coming over from Marfa, together with Capt. Hopkins and Lieut. Jessop of the West Yorkshire Regiment, I saw two Rooks passing over in a northerly direction. I saw also a Woodchat, very many Wheatears, some Hawks and Harriers, and a few Linnets; these last seemed to have nests.

12th.—A Black-bellied Sand-Grouse was sent to me from the market; it was brought over from Nadur (Gozo), where it was killed the day before. The wind to-day was a moderate north-west. Great Plovers, Turtle-Doves, Scops Owls, and Wagtails were seen, and taken in fairly good numbers; other birds

noticed were Tawny Pipits, Whinchats, Cuckoos, Hoopoes, Nightjars, and Rock-Thrushes; also two Rollers and a Redshank.

14th.—I found a Golden Oriole and a Spotted Flycatcher in the market.

15th.—I noticed the following birds in the market: 2 Marsh and 2 Hen-Harriers, 3 Kestrels, 1 Orange-legged Hobby, 75 Scops Owls, 11 Turtle-Doves, 2 Rollers, 1 Cuckoo, 1 Snipe, 39 Quails, 4 Whinchats, 1 Ruff, and 1 Green-headed Wagtail.

16th.—A strong north-westerly wind brought over many Swifts, Swallows, Wagtails, and Nightingales; also some Bee-eaters, Rollers, Hoopoes, Nightjars, Scops Owls, and Turtle-Doves.

17th.—I found a Golden Plover in full plumage on one of the stalls at the market, this being the first instance of my finding this species in that dress.

19th.—Almost calm. Some Squacco Herons were noticed during the day passing over in a north-westerly direction; a few of these were taken.

20th.—A very fine day, almost calm. We had a very plentiful passage of all sorts of Warblers. Kestrels and Bee-eaters passed also in fairly good numbers; of these last very few were taken, the majority having passed very high, and apparently without alighting.

21st.—A strong wind from the S.S.E. brought over many Turtle-Doves, Orioles, Cuckoos, Bee-eaters, Nightjars, and Scops Owls; a few Hoopoes and Kestrels, and some Short-toed Larks were also noticed, and a Teal was shot at the Ghadira of Melliha.

22nd.—Amongst the other game I picked up in the market 3 Quails which were just fledged.

23rd.—At the market I noticed the following birds: 17 Turtle-Doves, 15 Quails, 1 White-eyed Duck, 2 Little Bitterns, and 2 Pratincoles; these last were shot at the Marsa out of a flock of five. Some Bee-eaters, a few Hoopoes, Rollers, and Nightjars, and several sorts of Hawks were noticed.

25th.—Birds at the market: 141 Quails, 73 Turtle-Doves, 6 Short-toed Larks, 3 Golden Orioles, 2 Bee-eaters, 2 Rollers, 5 Nightjars. and 1 Short-eared Owl.

26th.—Amongst other birds I observed in the market fourteen Golden Orioles, the majority being immature birds.

27th.—Many Orioles again at the market.

28th.—Birds noticed in the market: 67 Turtle-Doves, 39 Quails, 1 Roller, 18 Orioles, 4 Ruffs, 3 Green Sandpipers, 4 Little Stints, 1 Pratincole, and an Orange-legged Hobby. The wind to-day was a light W. or N.W. and quite an inrush of Quails was noticed, especially at Nadur Gozo.

29th.—Game at the market: 1375 Quails, 67 Turtle-Doves, 8 Orioles, 2 Hoopoes, 5 Cuckoos, 3 Great Plovers, 2 Ruffs, 2 Green Sandpipers, and 1 Little Stint. To-day's wind was a moderate S.S.W. Many Orioles came over, and several were taken. I was told that the carob-trees in our valleys harboured a good number of Nightjars, with which sportsmen had a good time.

30th.—A very light wind, varying from E. to S.E. A pretty good passage of Turtle-Doves, Quails, and Nightjars; also some Orioles, Bee-eaters, Rollers, Hoopoes, Stone-Curlews, and Cream-coloured Coursers; of these last three specimens were taken.

May.

1st.—A fresh easterly wind. Turtle-Doves and Quails again in fairly good numbers; also an exceptionally abundant arrival of Nightjars.

2nd.—A very light wind from the E.S.E. during the morning; this turned to the W. in the afternoon, when several Turtle-Doves, Rock-Thrushes, and Lesser Kestrels were seen arriving.

3rd.—A light wind, varying from W.; a fairly good passage of Quails, some Turtle-Doves, a few Nightjars, Cuckoos, and and an occasional Little Bittern.

6th.—Captain Scott Hopkins reported to me that he had seen three Rooks in the vicinity of Hagiar Kim.

10th.—A moderate wind from the W. Some Storks were observed coming over from the north; two were taken in the vicinity of Birzebbugia, one being shot by Michele ci Bonnici (Tal Kerkni) and the other by Lorenzo Zammit (Ciaprott); Mr. G. Agius shot another at Marsascirocco. These three specimens were mounted by Mr. Conti. At the same time that these three Storks were shot from this end of the island, three others were taken at l'Ahrax (Melliha) at the other end; of these, one,

I was told, was obtained by Mr. L. Naudi of Robato, and one was kindly secured for me by my friend Prof. E. C. Vassallo, LL.D.; the other, I am afraid, was consigned to the pot.

12th.—A light wind blew from the N.W. I went to the Salina, where I saw a White-winged Black Tern, many Green and Curlew Sandpipers, several Ruffs, and some Little Stints.

16th.—A light or very light N.W. westerly wind: some Turtle-Doves and Orioles came over, and a flock of Purple Herons passed from the S.E.

18th.—A light north-westerly wind; we had a pretty abundant passage of Turtle-Doves, some Orioles, one or two Hoopoes, and several Hawks.

19th.—A light wind from the north and N.W.; Turtle-Doves again, and a few Orioles and Rollers.

22nd.—A very light easterly wind; Snipes, Ruffs, and some Curlew-Sandpipers; also a few Turtle-Doves, and an occasional Oriole.

26th.—I went to St. Paul's Islands, where I observed several Short-toed Larks, many of which were breeding. In that neighbourhood, at a place known as Ghar il Bies, I was glad to find two or three pairs of Jackdaws which had nests with young. On my way back to Valletta I observed a good number of Swallows and Martins; the wind at this time was blowing gently from the S.W.

28th.—Buzzards were again observed coming over from the same direction; Col. Francia sent me a young male shot by him at Pembroke on the same day.

30th.—A fresh easterly wind; some Ruffs were taken, one of which was in very fine plumage, but without the ruff.

June.

1st.—A few Ruffs at the market, and these were apparently the last to come.

19th.—About two-and-a-half dozen Linnets just fledged were brought over from Gozo to the bird-dealers at St. John's Square.

24th.—I observed a flock of Little Stints flying along the coast at Ghar id-dud.

26th.—Short-toed Larks still nesting, and nests with eggs were observed at Pembroke by Col. Francia.

27th.—Two young Kestrels were observed by Mr. Jos. Zammit flying about the barren rocks in the vicinity of Krendi.

As can be seen the scarcity of birds during this month has been rather exceptional, as even the common Sparrows of Malta seemed to have disappeared. This was, perhaps, due to the excessively high temperature for a rather large part of the month.

MIGRATION NOTES FROM A PASSENGER STEAMER.

By Hugh Whistler.

On April 25th this year I sailed for England from Karachi in one of the passenger steamers belonging to the City Line, and during the voyage kept notes of all birds seen; as many of these were land-birds on migration, it may be of interest to place on record the ornithological diary of the voyage.

April 25th.—Embarked at Karachi, and started during the afternoon; in the harbour were many Brown-headed Gulls (*Larus brunneicephalus*) and a few Black-backed Gulls (*Larus affinis*); a single individual of the Sooty Gull (*L. hemprichii*) was also noted; a few other birds seen were perhaps Terns.

April 26th.—Land visible in the distance during the greater part of the day. A single Swallow (*Hirundo rustica*) appeared and accompanied the ship for some time. A few Tropic birds were probably *Phaëthon flavirostris*; a species of Tern were noted, with black cap and bill and upper parts; this I presume to have been the Sooty Tern (*Sterna fuliginosa*).* A female Rose-ringed Parroquet (*Palæornis torquatus*) flew about round the ship for a time, but this perhaps had escaped from one of the many cages in which Lascars were taking Parroquets to England for sale.

April 27th.—Entered Bombay Harbour about 2 p.m.; no birds were seen until we entered the harbour, where *Larus brunneicephalus* was found to be numerous; a few had already assumed the chocolate mask.

* No doubt; it was a very familiar species on the voyage to and from India in our own experience. [Ed.]

With the Gulls were a few Terns, which I was unable to identify; they were about the size of the Indian River Tern (*Sterna seena*), with short-forked tails, and of a nondescript grey colour, with no particular markings, save a black mark near the eye; the bill was black. It is possible that they were Gull-billed Terns (*Sterna anglica*) in non-breeding dress.

April 28th.—Arabian Sea. The only bird seen all day was a small passerine, which followed the course of the ship for for about half an hour against the wind; by flight, appearance, and note it seemed to be some species of Wagtail, yellowish in colour, with white in the tail, and perhaps a chestnut head.

April 29th.—Arabian Sea; no birds seen.

April 30th.—Arabian Sea. A few Black and White Gannets, namely, a party of three and a single bird, were doubtless the Masked Booby (*Sula cyanops*).

A good many Shearwaters (*Puffinus sp*, ?) were observed during the day.

May 1st.—Arabian Sea; a party of three of the Gannets seen, as well as one or two solitary individuals. Shearwaters were plentiful.

May 2nd.—Arabian Sea. Position at noon: Lat. 14°·00′, long. 57°·03′; 358 miles to Aden.

About 10 a.m. a Nightjar (*Caprimulgus sp.*?) came aboard, and flew about for some ten minutes, perching occasionally; after this it disappeared, but must have hidden somewhere in the ship, as it was flying about both in the morning and evening of May 3rd. I did not see it on the 4th, but it was still with us before breakfast on May 5th—a good example of an "assisted passage."

Shortly before dusk a party of nine Bee-eaters, which looked like *Merops philippinus*, passed flying eastwards low over the sea with the typical hesitating flight of the species.

Fewer Shearwaters were noted than yesterday, and one or two Gannets, in addition to a party of four, which were resting on the sea.

May 3rd.—Arabian Sea. A male Rose-ringed Parroquet (*Palæornis torquatus*) was flying round the ship and settling on the rigging; it was doubtless one of the Lascars' birds.

Only two or three of the Shearwaters seen, and perhaps a Gannet or two.

May 4th.—Position at noon: Lat. 12°·53′ N., long. 43°·15′ E.

We halted at Perim from 6 to 10.30 a.m. in order to coal. The Sooty Gulls (*Larus hemprichii*) were common in the harbour; with them were a few Black-backed Gulls (*Larus affinis*). The only other birds noticed were two distant flocks that appeared to be composed of Pigeons.

Sooty Gulls were very numerous for the rest of the day in the Red Sea.

May 5th.—Position at noon: Lat. 16°·53′ N., long. 40·42 N.; land visible all day.

Sooty Gulls followed the ship during the morning; a good many sea-birds seen in the distance during the day were probably Gulls, but one of a dark colour was apparently a Gannet or Cormorant.

About 6 p.m. a Swallow (*Hirundo rustica*) arrived on the ship, and, after flying about for some time, settled on an awning. Another bird had come aboard in the morning, but I did not see it; the description sounded like that of some species of Kingfisher.

May 6th.—Red Sea. No sea-birds noted.

About 8 a.m. a Dove, apparently *Turtur risorius*, arrived from the south, and passed low over the ship. Later another Dove arrived, which was clearly the Common Turtle-Dove (*Turtur communis*). Then I observed two large Doves and a smaller one flying near the ship, but could not make out whether they included those seen previously or not.

About 10 a.m. a Quail (*Coturnix communis*) approached the ship, flying low over the waves, and then went away again in the direction of the African coast.

May 7th.—Red Sea. No sea-birds noted.

Only three birds were seen; these were a Turtle-Dove (*Turtur communis*), a Swift, which looked like *Cypselus apus*, and headed south, and a small unidentified brown bird, which was flying parallel with the ship for some time.

May 8th.—Red Sea. Position at noon: Lat. 20°·34′ N., long. 32°·51′ E.

A Swift or Swallow seen flying southwards, and a yellowish

Wagtail (which might have been *Motacilla boarula*) was observed flying in the same course as the ship was steaming. A few sea-birds noted in the distance.

About 10 a.m. a stream of large raptorial birds, about a hundred in number, were observed flying over from the African to the Arabian shore; they flew at no great height above the sea, roughly one to two gunshots, and followed the same line in the straggling formation of a flock of Rooks; about 11 a.m. a smaller flight of some twenty individuals were noted, and another dozen odd birds about a quarter of an hour later. These birds were all apparently of one species, and from their flight, general appearance, and wing-markings I took them to be Honey-Buzzards; the lower parts of some individuals that passed over the ship were transversely barred.

About 6 p.m. we entered Suez Harbour; here the White-eyed Gull (*Larus leucophthalmus*) was abundant, a handsome species, with sooty mantle and wings, the latter edged with white, black head, white eyelid and neck, and a bright reddish or orange bill. There were also many Black-backed Gulls (*Larus fuscus* or *L. affinis*) and one or two Skuas, of which I was unable to identify the species.

May 9th.—Left Suez about 10 a.m. In the Suez Canal my attention was directed chiefly to matters military and not ornithological; however I observed a flight of Swallows (*Hirundo rustica*) between Suez and Ismailia, and several others in the canal proper. No Gulls were seen until we reached the Bitter Lakes, where *Larus leucophthalmus* was common; further on in the canal again a single Black-backed Gull was seen. Other birds seen were a Teal, a Raven, some Coots, and a pair of Spur-winged Plovers (*Hoplopterus spinosus*), which were running and calling on the bank of the canal.

May 10th.—Spent the day in Port Said Harbour; the only species of Gull frequenting the harbour was a Lesser Black-backed Gull, but I was unable to distinguish whether it was *Larus fuscus* or *Larus affinis*.

May 11th.—Sailed from Port Said at noon, and saw no birds after that save three parties of large Gulls, respectively of nine, three, and six individuals, who were also following the same line of flight in the Mediterranean. No details of our course or of

of the lands viewed were allowed us, so I am unable to say whereabouts the birds noted below were met with.

May 12*th*.—Mediterranean Sea. The only birds about were a few brown-and-white Shearwaters (*Puffinus sp.* ?), and a small Hawk, possibly a Kestrel, which passed over, going towards the African coast.

May 13*th*.—Mediterranean Sea. Crete viewed in the morning. A Dove was seen in the morning; another arrived from an easterly direction about 5 p.m., and one, perhaps the same, was still about at dusk. All were apparently Turtle-Doves (*Turtur communis*). A Swallow (*Hirundo rustica*) was flying about the ship for an hour or two before noon.

About 5.30 p.m. a flight of five or six House-Martins (*Chelidon urbica*), accompanied by a single Sand-Martin (*Cotile riparia*) arrived, and the House-Martins kept on settling on the ship and following it until dusk.

Two or three Shearwaters were seen, and there were a few Herring-Gulls about all day: one came near enough for me to distinguish the yellow legs of the Yellow-legged Herring-Gull (*Larus cachinnans*).

May 14*th*.—Mediterranean Sea; no land visible all day.

This was a great day for migration. Many Turtle-Doves (*Turtur communis*) were observed at different times, on one occasion seven or eight arriving together.

A very large flight of House-Martins (*Chelidon urbica*), accompanied by a few Sand-Martins (*Cotile riparia*) and Swallows (*Hirundo rustica*) arrived about 4 p.m. Some of these were very exhausted, and were caught by the hand as they settled on the upper works and decks, and I fancy that several must have died. The stomachs of a House-Martin and Sand-Martin that I examined were empty. A few House-Martins were also observed throughout the day, and a flight of about thirty were following the ship in the evening and settling in rows on the ropes that secured one of the after boats.

A male Red-footed Falcon (*Falco vespertinus*) arrived in the afternoon, and, failing to catch any of the House-Martins at which he struck, took up his station on the davits of a boat. A Lascar climbed up the davit, and with a quick grab caught in his hand the little Falcon, which was sitting all unsuspicious.

This bird came into my possession, and I skinned it. The plumage was very worn, and there was very little fat on the body; in the stomach were slight traces of insect remains. Another Hawk was seen at dusk striking at the Martins that followed the ship. It appeared to be a Kestrel (*Tinnunculus alaudarius*).

During the afternoon two or three Spotted Flycatchers (*Muscicapa grisola*) were catching flies about the deck with but little fear of the passengers.

A Quail (*Coturnix communis*) was seen flying on the same course as the ship in the morning, and a bird that I caught one glimpse of in the evening was a apparently a Common Sandpiper (*Totanus hypoleucus*).

Four Shearwaters were observed in all.

May 15*th*.—Mediterranean Sea. Some land viewed was reputed to be Cape Bonne. Before breakfast a Quail (*Coturnix communis*) came aboard, and took cover under a donkey-engine. An unsuccessful attempt at capture was made, and the Quail flew out to sea again.

The only other migrant observed was an extremely ragged-winged Turtle-Dove which settled on the ship in the evening.

A few Gulls that were following the ship were Herring-Gulls, but I did not identify the species.

A very large flock of Shearwaters were passed in the evening; some of these birds settled on the water, the first time I have seen any of the genus at rest.

May 16*th*.—Mediterranean Sea; land visible most of the day.

Many Herring-Gulls followed the ship, some of which were clearly *Larus cachinnans*.

May 17*th*.—Reached Marseilles early, and continued my journey by the overland route.

NOTES AND QUERIES.

AVES.

Notes from Sussex.—Owing to an abundance of hornbeam-seed, I had expected a fairly good arrival of Hawfinches, and they began to appear during the latter part of November, increasing the following month, the largest number seen by me at one time being twenty-one, on December 17th. As usual, a few passed the nesting season in the district, and some young were successfully reared. A shortage in alder-seed was responsible for the small number of Lesser Redpolls which spent the winter here, but the spring arrival of nesting birds was about the same, possibly rather more; indeed, I have never known a spring during which single Redpolls so often came under my notice, though it is doubtful if more nested than usual. A little party of Siskins (*Carduelis spinus*) paid me a visit on January 18th, and some of them continued to come into the garden throughout February and the first fortnight in March, but I was certainly astonished at seeing two there on May 6th—a Siskin has never before been seen by me in May. Rather fewer Redwings spent the winter here than is generally the case, and I did not see a Fieldfare until February 24th, when we were having snow. This is not a Fieldfare district, but during a spell of heavy snow these birds will suddenly appear and invade the woods and shrubberies in large numbers. A small flight, south-westerly, of Fieldfares, together with Mistle-Thrushes and Lapwings, occurred on February 26th, 27th, and 28th, and a few Black-headed Gulls (*Larus ridibundus*) appeared. However, such Fieldfares as passed through the district on migration two months later were in no great hurry to leave us, and some were here as late as May 2nd. I saw very little of the Brambling at any time during the winter. On March 25th there was a beautiful Great Grey Shrike (*Lanius excubitor*) in Buxted Park, only the second authentically seen by me during a period of some sixteen years' residence. One was seen by me in Maresfield Park, January 5th, 1912. Of our summer migrants the Nightingale cannot be said to have been other than poorly represented; I do not think more than six or seven were located by me, but there has been a slight increase in the numbers of the Wood-Warbler (*Phylloscopus sibilatrix*), the House-Martin (*Chelidon urbica*), and the Turtle Dove (*Turtur communis*), whilst most of the others have been here at about the average, and the Red-backed Shrike (*Lanius collurio*) has been better

represented than usual, though this is not a Shrike district. As regards the Willow-Warbler (*Phylloscopus trochilus*), I would call attention to an alteration in its nesting-habits, as the same may have been observed in other localities. Owing to a series of very wet winters and early springs, this little Warbler has arrived to find its former nesting-sites exceedingly damp, and, in some instances, under water, and as a consequence woodlands which should have been filled with it and ringing with its lively notes, have during the past few years become almost deserted. One might easily suppose that a decided falling-off in number had occurred; indeed, I do not deny that fewer may have been arriving here during the past five or six years, but, as a matter of fact, there have been of late many more what may be described as outlying pairs of Willow-Warblers than formerly. It would be interesting to know if this has been noticed by observers in other localities. To form some judgment as to the number of birds affecting a well-wooded and strictly enclosed district one must rely, to a certain extent, upon the amount of song he hears, and they did not give us very much this year—in fact, the cold, damp, and gloom which so often prevailed some time after the arrival of our summer birds undoubtedly had a depressing effect upon them, and very little was to be heard of them. Chiffchaffs already had a partly-built nest in my garden before I had heard one note uttered; in fact, I did not know a Chiffchaff was on the premises, and the cock must have mated without a song and did exceedingly little singing afterwards. The Grey Wagtail (*Motacilla melanope*) again arrived for nesting, and three spots affected by pairs were known to me. On May 27th I watched a female completing the lining of a nest, but unfortunately this nest was in full view of anyone crossing the bridge near which it was built, and was stolen. Otherwise it was, to me, especially interesting as being the first nest of the Grey Wagtail I had ever seen. Great Spotted Woodpeckers (*Dendrocopus major*) nested in the same tree used by them in 1912, a small decayed oak standing among Scotch pines, the hole being at about twice the height of that bored by them four years ago, when it was rather less than eight feet above the ground. The few nests of the Great Spotted Woodpecker seen by me here have been in oak, cherry, and Scotch pine. The arrival of our breeding Greenfinches was quite up to the average, but Linnets showed a falling-off. I think rather more Herons pay visits to the neighbourhood than was the case some years since, and in "British Birds," vol. i., p. 360, there is a notice of an article which appeared in the "Hastings and

East Sussex Naturalist" in which it was stated that a new colony of Herons "was formed last year at Plashett Park, near Lewes." I do not know if the birds continued there, but if they have done so, that may account for their more frequent visits to this neighbourhood, as "The Plashett" is not much more than two miles outside the parish of Uckfield. However groundless my ideas may have been, I have never been a great believer in birds, after an absence of some generations, returning to their ancestral breeding haunts, but some forty years ago I often took walks with my father in the vicinity of Plashett Park, and well remember him more than once remarking; "There used to be a Heronry here at one time, but the keepers destroyed it, because they said the birds took the fish." I do not think he ever saw it, nor can I remember that he mentioned any date in connection with it, but he must have known of its existence. My father was a native of Lewes, where he was born in 1828. Regarding the birds in my garden, Thrushes were building in January; Blackbirds reared three broods in the same nest, which I have never known them do before; and Wrens abandoned a nest in a small rustic summer-house after using it six years in succession. This nest had become very dilapidated. After causing me much anxiety and disappointment, my Wrynecks left me this year—their most successful year was 1912, when a brood of nine was brought off. —ROBERT MORRIS (Uckfield, Sussex).

Abnormalities in Mandarin and Muscovy Ducks.—In confinement, at any rate, the male of *Aex galericulata* seems rather inclined towards colour-variation, although the specimens coming to hand of late years have been mostly wild-caught; while its ally, the Carolina (*Aex sponsa*) is still, after many years of breeding in captivity, as true to colour as a wild bird. The most remarkable colour-aberration in the Mandarin I have ever seen was in a specimen Mr. J. D. Hamlyn had on sale with many others about 1910 or 1911: my notes do not give date. This bird, a small specimen—smaller, in fact, than a normal female—presented three remarkable abnormalities: (1) there was no copper area in the crest, this being all dark-green and white; (2) the inner expanded webs of the innermost secondaries, which form the fans, were black, with a slight gloss of green towards the edges; there was no trace of the white edge, nor of the "snip" of rufous on the inner web, the whole fan being dark; (3) the face showed none of the buff shading usual round the eye and over the lores, but was completely white up to the green of the forehead, down to the jaw, and back to the origin of the hackled frill.

Thus this bird really looked like a new species of *Aex*; the white face was not ordinary albinism, for as the bird went into undress it became mottled with the appropriate colour (grey) for that phase.

Another drake, also, in a large lot deposited by Mr. Evans, of Chicago, in the Zoo in 1912, had the same white face, but with normal fans; Edwards' figure, apparently the first one of the species, also shows such a bird. Although the white face looks at first sickly and unpleasing, it is, so to speak, more consistent with the rest of the Mandarin's violently-contrasted colour-scheme than the normal buff shadings, and so may be called a progressive variation. But as last year a bird at Kew, with the left eye missing, had this well-defined white on that side only and yet moulted into normal undress on both sides and assumed normal buff there after that, we are faced with one of the many cases where progress seems pathological.

This summer I came across a male specimen of the ordinary domestic race of the Muscovy Duck (*Cairina moschata*) showing an altogether abnormal development of the bare red skin of the face. This extended all over the head except on the crown and throat, invading the forehead and chin to the level of the eyes, leaving the ear-orifices exposed, and running down the sides of the neck to the level of the end of the nuchal portion of the crest—to the point, in fact, where the green on a Mallard's neck ends. The skin was seamed on the neck, but not carunculated on the face, though there was the usual Swan-like caruncle at the base of the bill. (I have never seen the carunculated face in English-bred Muscovy Ducks, only in African, Indian, and American specimens, and it is not universal in these.) The bird was healthy and not moulting; it was a large, heavy specimen, and, from its stiff gait, I should say very old. It had no abdominal flap or "keel" such as one often sees in this and other domestic Ducks and Geese, and its colour was that of the wild race—black with white wing-coverts—but with a large admixture of white on the neck and breast, a flesh-coloured bill, and light yellowish feet. It was inactive even for its sluggish species, and I never saw it erect its crest when challenging another bird.—F. Finn.

Note on the Nesting of the Wren.—Some time ago this season I visited a friend, and noticing some birds' nests in his home I made the remark, "This appears to be a cock Wren's nest, and a fine one too," and enquired where he had met with it. He told me it was a cock's nest, as I surmised, but, it being such a fine nest, he took it home in July, and to his surprise he found it to contain eggs—five,

I believe—not one of which was broken, although he had very carelessly put the nest into one of his pockets. I think it is not a common occurrence for such nests to be utilised for breeding purposes. Sometimes they are used as temporary sleeping-quarters for newly-fledged young, after they have left the nests in which they have been reared. The Wren has again this year brought off its young in my poultry-run. It has utilised the same crevice in the old bridge over which runs the foot-path from our Council school to an outlying hamlet. The nesting-site is very similar to the one chosen by the Great Tit on the opposite side of the bridge; no part of the Wren's nest could be seen from the outside.—E. P. Butterfield (Wilsden).

Distribution of the Linnet in Britain.—In the 'Zoologist' for 1911, p. 70, Mr. Stubbs, referring to the breeding of the Linnet, states that this species is rare in or absent from a tract of country—apparently suitable too—from Hebden Bridge to, say, Glossop and parts of North Derbyshire. It may be of interest to state that in walking to Castle Carr *viâ* the way of Ogden Moor belonging to the Halifax Corporation, in July, I saw in a clough at the latter place a pair of Linnets which were evidently breeding; but my time being limited I did not search for the nest, or probably young—I have found this species with young at the end of August. In walking from Chatsworth Park to Chesterfield I found the Linnet breeding not at all uncommonly, and in and about the Peak district I think I have noted this, but I will not be positive. It is, however, fairly common in the Huddersfield district. In all parts of Yorkshire I have visited wherever there are whin-covers I have never noted an absence of this species in the breeding season. During the past summer I found five nests in the districts, one or two in curious situations. One, the first I found, was built close to a foot-path in some dead fronds of the bracken of last year's growth which had pushed their way into the lower branches of a hawthorn and had remained standing through the winter. Within about a hundred yards another was built in a lateral branch of a pine-tree, whilst another was built in a spruce about seven feet high. All these were built within a radius of about two hundred yards. One which I found on Baildon Moor was built in a small whin, but the nest was quite on the ground. This bird, however, for some reason forsook its nest. I was very pleased to read Mr. Stubbs' notes, to which I have referred, since it is always interesting to read of any bird which is said to be common and generally distributed, but which in certain areas—and apparently suitable ones too—is absent or very rare. Some years ago

I spent a month in North Yorkshire in a deep valley, and I was surprised to find that both the Common Sparrow and Skylark were very scarce. Indeed I have always found that the Skylark does not affect deep valleys in any numbers during the breeding season. —E. P. Butterfield (Wilsden, Yorks).

Food of the Ring-Dove.—Last summer my attention was called by many people to some birds which visited a field near our recreation ground, and continued their visits day after day for some time. On my going to the field in question I found them to be Ring-Doves. Taking my field-glasses I could plainly see they were feeding upon the seeds of a certain grass, and on going to the particular place, I found it was one of the soft grasses (*Holcus*); and on returning home, I saw a Lesser Redpoll feeding upon the seeds of the same grass growing in the recreation field.—E. P. Butterfield.

Rooks and Railways.—What more natural than that Rooks should be found frequenting and building their nests near railways? Rooks very soon learn to ignore trains, and find that they are less persecuted near railways, where there are few trespassers to disturb them. Besides this, there is always a certain amount of scraps of food thrown from railway trains, and lying about stations and signal-boxes. Rooks and other birds also frequent laden railway trucks, especially in sidings, from which they pick up a leakage of grain, seeds, and food-stuffs. I have specially noticed this in railway yards on Sundays, when no workmen are about. In hard weather Rooks frequently feed on the train-oil which is used to oil the wheels of the rolling-stock and often oozes from the oil-boxes. Under these circumstances it is not to be wondered at that Rooks are found sitting on telegraph wires, on the look-out for food, and nesting near railway lines. The habit of Rooks of often building their nests in the most frequented thoroughfares of some of our large towns is no doubt attributable to the fact that they find more security there from egg-collectors and others, and also to some of the same causes which I have mentioned as attracting them to railway lines. I think Mr. Finn will find that his interesting observations on Rooks on his journey from Tiverton to London will hold good on many, if not on most, railway lines in the kingdom where Rooks are generally to be found.—John R. B. Masefield (Rosehill, Cheadle, Staffordshire).

Storks or Cranes at Gallipoli.—In Mr. D. A. J. Buxton's paper on "Birds seen during the Gallipoli Campaign" it is stated ('Zool.', pp. 415–416) that large flocks of what were believed to be Cranes flew southward, uttering loud clanging notes. In a paper by Captain

Boyd these birds seemed to have been identified as Storks, and the matter is left undecided. As Storks have no note, and the loud clanging note is characteristic of the Cranes, there can be no doubt that the birds observed were Cranes. The "clappering" noise made by the Stork is produced by mechanical means only*.—F. C. R. JOURDAIN.

Longevity in a Magpie.—A friend tells me has known a Magpie for twenty-four years, and it had been with its owners some time before that. "He" had been with them for sixteen years, always being referred to as "he" and named "Mac," when "he" scandalised his large circle of friends by laying an egg! This was the only occasion. He was very fond of beer, which evidently agreed with him. From what I can gather, Mac's seems to have been "a long life, and a gay one."—(Miss) A. PREYSS.

An Unusual Blackbird's Nest.—This spring, when visiting the Horniman Gardens, I found a Blackbird's nest in a very exposed position. The nest was in a small hollow of an oak-tree, about six and a half feet from the ground; this is rather high for this bird. The female as well as the male was orange-billed. There were five eggs of the usual colour. The birds deserted their nest before the eggs were hatched, evidently disturbed by the numerous visitors to the Gardens.—ERIC L. KELTING (London).

Status of the Stonechat in North-West Yorkshire.—Under the above heading my old friend Mr. E. P. Butterfield quotes me (*ante*, p. 398), as reporting a pair of Stonechats with one young one—the latter fairly strong on the wing—this summer. As Mr. Butterfield does not give any date, and as the locality stated is not strictly accurate, I am sure he will excuse my adding the following particulars, in order to avoid the possibility of any confusion arising in the future. The spot was actually at Threshfield, but close to Grassington Railway Station, in Upper-Wharfedale. Mr. D. Sutcliffe reported that he had seen a pair of Stonechats there on June 19th, and on July 8th I went, as directed, and saw the three birds at the exact spot in the same field. It was a very windy day, and there may have been other young hiding in the long herbage; but I could not see signs of any more. Personally, I have not the slightest doubt but that these birds had nested there: although, as

* Most probably both species were present, as suggested by Mr. Buxton (p. 416); the identification of Cranes by their note does not exclude the presence of Storks as well, which would be very difficult to distinguish from them when flying at a height or in the dusk. [ED.]

Mr. Butterfield suggests in his note, it would have been more satisfactory to have actually found the nest. As I did not hear of them until three or four days before I went, this would have been an almost impossible feat in my case. But my experience of Stonechats in districts where they nest fairly commonly is that this is one of those species where both old and young birds keep fairly close to the nesting-site for some considerable time after the young have left the nest. However, these are the first, and only, Stonechats that I have been able to see in the West Riding in the nesting season, and during the last thirty years I have tramped very many hundreds of miles in order to find them, or to endeavour to verify reports. As recorder for vertebrate zoology to the Bradford Natural History and Microscopical Society for nearly a quarter of a century, I have been wishful to add the Stonechat to our list of known breeding species. Unfortunately the local name here of the Wheatear is "Stonechat," and in many cases that has helped to confuse matters. *Saxicola rubicola* is a bird of passage with us—at times remaining a few days, or even a few weeks, in one place—in October or November, and again in February or March. Mr. W. Greaves, however, informs me that a pair of Stonechats, the first Stonechats recorded for that district, remained in the neighbourhood of Hebden Bridge last winter from October to February; certainly an unusual occurrence for North-West Yorkshire. Very curiously, when I sent Mr. W. H. Parkin word that there were Stonechats near Grassington Station, which had apparently nested there, he replied that he had seen a female Stonechat with "feed" in her beak on July 9th at Menston, in the same dale, and within four miles of my house. Neither Mr. Parkin nor I were, however, able to find any further trace of this lady or her relatives.—Harry B. Booth (Ben Rhydding).

Yellowhammers' Nest in Rick.—With reference to Mr. Cocks's note on the nesting of the Yellowhammer (*Emberiza citrinella*) in a rick (*ante*, p. 352) I have found in former years at least two nests in this district built in field hayricks. One of the nests contained the feathers of a young Cuckoo, probably killed by a Rat. Ricks are often chosen for nesting sites, and it is not unusual to find two or three species nesting in the same rick.

Besides the Yellowhammer I have found the following birds breeding in ricks: Blackbird, Thrush, House-Sparrow, Robin, Wren (most frequently), Pied Wagtail, and Spotted Flycatcher; and no doubt other birds have been recorded.—S. G. Cummings (9, King Street, Chester.)

Yellow Wagtail in Bedfordshire in November.—On November 11th, whilst my son and I were walking around the Sewage Farm at Newnham, we observed a Yellow Wagtail; it was either an adult female or a bird of the year. I have never previously known this species occur in this county later than the end of September; numbers remain as a rule until the second or third week of that month, but soon after all have passed southwards. I have notes, September 19th, 1909, of numbers being seen at Blunham; September 29th, 1907, of solitary birds seen at Copley and Great Barford; on the same date, in 1912, one at Newnham; and on September 23rd, 1911, one at Shefford. When such belated migrants as the above instance are observed, there is always the doubt that some injury has been the means of preventing their leaving this country. I spent some time in watching this particular Wagtail, and I came to the conclusion that, although apparently fully active when on the ground, it was reluctant to take wing, and it allowed us to approach to close quarters.—J. STEELE ELLIOTT.

PISCES.

Meaning of "Skull Slyce."—Many kinds of fish are enumerated in the Household Accounts of the ancient family of Lestrange of Hunstanton (Norfolk), which fortunately are preserved from 1519 to 1578. Among the kinds mentioned is one called the "Skull Slyce," which at present has not been identified; Mr. Hamon le Strange, the present owner of these singular manuscripts, also finds the word to be spelt *Sculleslyes*, and *Skulk Slyce* in one passage. The prefix "Skull" or "Scull" probably denotes the Plaice; *Skolla* and *Sandskädda* are Swedish names for this species, and *Skulder* Danish, but the second word "Slyce" is a complete puzzle, and assistance in explaining it would be welcome.—J. H. GURNEY (Keswick Hall, Norwich).

GASTROPODA.

Behaviour of Chiton Ruber.—An example of this mollusc, closely attached to the shell of a living *Anomia ephippium*, obtained at Weymouth, was placed in an aquarium on October 1st, 1915. It was observed almost every morning that the Chiton had shifted during the night to a different part of the shell, though it was never seen to move in the daytime. During the night of its eighty-first day of residence in the aquarium it quitted the shell of the *Anomia* and settled upon that of a contiguous *Anomia*. On the 150th night it returned to the first shell, where it remained for only a few days,

subsequently migrating to a third *Anomia* shell, and finally to a stone. All the shells and the stone were in contact. The Chiton died during the 325th day, and it was found lying curled up on the sand at the base of the stone. It fed on the minute brownish vegetable growth which existed on the shells and stone, and this growth was systematically cleared from each of these objects before the Chiton quitted it. The Chiton, which was about 10 mm. long, was always in the daytime pressed closely against its foothold; and its colours (bright red and white) and markings, especially on the stone, were in harmony with those of its surroundings, so that it was often very difficult to find it.—H. N. MILLIGAN.

INSECTA.

Wasps' Nest in a Gun.—It was not until July 20th, when a little swarm of Wasps flew around the muzzle of an old ship's gun, that I knew of my possession of Wasps. This gun, which most likely came from the Sussex port of Newhaven, and probably did duty aboard a "privateer" in the early years of the last century, stands on a small bit of lawn at the back of the house, and Great Tits and Coal Tits have already built in it; but not until this year has it been occupied by Wasps. It may be said that on a truly hot summer's day I have hesitated to rest a hand on it for any length of time, and when we had a short outburst of summer weather after the middle of July the Wasps found the heat too great for them by the early afternoon, and all the ordinary routine of the colony ceased—those that arrived either refused to enter, or, if they did, quickly came out again. To improve matters, they adopted a simple means of sending a draught of cool air up the bore of the gun, and that was done by some two or three dozen assembling just inside the muzzle and vigorously vibrating the wings; and this was kept up until the ancient piece of ordnance became shaded by a neighbouring shrub, when the Wasps again returned to their usual duties. I may have over-estimated the perspicuity of *Vespa*, but it seems doubtful to my mind if a queen Wasp would have endangered the existence of the colony she was about to establish by selecting such a site for the nest if there was going to be a full amount of sunshine; in any case, it must be admitted that sunshine has been sadly lacking during the past spring and summer. Nevertheless, having no desire to combat the opinions of those who assure us that the heavy gunfire in France and Flanders is responsible for the clouds and rain we have been having, and which I can hardly think a queen Wasp would

have taken into consideration, it would be as well to say that this nest is not in a flourishing condition, and when this was written seemed about to fail altogether.—ROBERT MORRIS (Uckfield, Sussex).

ASTEROIDEA.

Growth and Regeneration in Solaster papposus.—*Growth:* On May 19th, 1915, a Sun-Star (*Solaster papposus*), 40 mm. in diameter, was placed in an aquarium, in which it lived for 375 days, and when the animal died it had attained a diameter of 90 mm. The average rate of growth of the Sun-Star was therefore 1 mm. in every seven and a half days. The Sun-Star was fed on dead and living *Asterias rubens*, mussel, shrimp, and fish. *Regeneration:* The Sun-Star had been in the aquarium for seventy-nine days when a piece, 8 mm. in length, of one of its rays was removed in order that its regeneration might be observed. The injured ray quickly healed, developed a new terminal "eye-spot," and continued to add to its length. Its rate of growth, however, was only equivalent to that of the other rays, and consequently it was still about 8 mm. shorter than the others when the animal died.—H. N. MILLIGAN.

Correction.—In the 'Zoologist' for November, 1916, p. 434, I mentioned the occurrence of a white Curlew. I did not see the bird, but later ascertained from Williams, Dublin, by whom it was set up, that it was a pure white Whimbrel, shot in May, 1915.—ROBERT F. RUTTLEDGE (Bloomfield, Hollymouth, Co. Mayo).

NOTICES OF NEW BOOKS.

British Birds. By A. THORBURN. Vol. IV. London: Longmans, Green & Co. £1 11*s.* 6*d.*

The last volume of Mr. Thorburn's admirable work completes the crescendo of the series; dealing as it does mainly with sea and shore birds, the opportunities for natural grouping are of the best, and the rendering of attitudes, etc., are more uniformly excellent than in the other volumes. We think that all of Mr. Thorburn's plates, mounted as pictures, and hung round the walls, would be infinitely better fittings for a museum than stuffed specimens, the exhibition of which only encourages the killing of rare birds; skins could always be kept in cabinets for reference by students. Some mistakes in spelling are all we note for comment in the letterpress—"Wooley" for "Wolley" (p. 3) and "Glaucus" for "Glaucous" (p. 69).

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